

## **APPENDIX I**

### **ALTERNATIVE SOURCES OF BASIC CONSTRUCTION MATERIALS**



**Analysis of the "Practicability" of Non-Lake Belt  
Alternative Sources to Supply Florida's Demand for  
Basic Construction Materials**

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# **Analysis of Practicability of Non-Lake Belt Alternative Sources to Supply Florida's Demand for Basic Construction Materials**

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# **Analysis of the "Practicability" of Non-Lake Belt Alternative Sources to Supply Florida's Demand for Basic Construction Materials**

## **Executive Summary**

The purpose of this report is to use federal criteria to determine the practicability of alternatives to limestone mining in the Lake Belt. This area presently supplies more than 1/2 of all the coarse and fine aggregate crushed stone needed throughout the state for building and maintaining public and private infrastructure. Without the Lake Belt these essential materials would be in critical short supply locally and throughout the state.

Lake Belt mining began in the 1950s and has been fully approved by local, state and federal, zoning, planning and permitting agencies. The Lake Belt Plan deals with on-going and future mining and is the result of more than seven years of evaluation of alternatives by the Lake Belt Committee, the Federal Working Group, Federal, State, Regional and Local Agencies, and statutorily mandated representation from the environmental and conservation community, and from non-rock mining private property owners, with oversight by the Florida Legislature. The February 1999, Draft Lake Belt Environmental Impact Statement (EIS) acknowledged this extraordinary scrutiny but did not provide great detail on the evolution of the Plan. Commentors to the Draft EIS requested additional information on whether practicable alternatives are available. This report is in response to those requests.

Lake Belt Rock products are the primary constituents of concrete, asphalt, road base and other products used to build essential human infrastructure including roads, bridges, airports, parking lots, office buildings, warehouses, retail stores, housing, schools, colleges, religious structures, hospitals, etc. This infrastructure is universally built with quarry products.

Relative to other areas of the United States, Florida has an extremely limited supply of construction grade rock. This is especially critical because the population of this state is growing rapidly and needs huge quantities of rock to build and maintain infrastructure. In 1998, the State's total use of 120,000,000 tons amounts to about 8 tons for every person in the State, every year. Including the Lake Belt mining area, Florida is projected to have only a 30 to 50 year supply of rock from all sources in the State.

Rock products are categorized by the USGS and the mining industry as follows:

- Crushed Stone, Coarse crushed stone ( $3/16$ " and larger) is produced by mining, crushing, and sieving solid strata of rock as in the Lake Belt Area. Fine crushed stone (less than  $3/16$ " - manufactured sand)

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is a necessary byproduct which is recovered by smaller screens in the sieving process.

- Sand and Gravel are naturally occurring materials that are washed and sieved into various sizes
- Road Base, is a gradation of sizes with specific chemical characteristics
- Cement is processed from limestone high in calcium carbonate
- Fill is considered a quarry product but not necessarily tracked by the USGS.

Coarse Crushed Stone or Gravel comprises slightly less than 1/2 of the volume of all concrete and asphalt. Coarse Crushed Stone or Gravel must meet certain physical and chemical quality requirements or the concrete and asphalt will not be durable or sufficiently strong. There is essentially no gravel available in Florida and there is a critical shortage in Florida of coarse crushed stone that meets FDOT quality specifications. In 1998, Florida needed approximately 39.4 million tons of coarse crushed stone, more than half of that volume was produced in the Lake Belt. The September, 1999, U.S.G.S. Mineral Industry Survey for Florida states: "the larger size limestone aggregates are becoming a limited resource in the State." The Lake Belt presently supplies 54% of the State's larger size limestone aggregates and as other FDOT approved mining areas in the State become depleted, Lake Belt rock will become even more crucial in supplying the State's construction needs.

Fine Crushed Stone or Natural Sand also comprises slightly less than 1/2 of the volume of all concrete and asphalt. Like the coarse fraction, it must also meet certain physical and chemical quality requirements or the concrete and asphalt will not be durable or sufficiently strong. While there are sand deposits along Florida's central sand ridge, this material can not supply all the size fractions needed to produce quality concrete block and asphalt.

There are only a few locations in the State with geological formations that produce coarse crushed stone that meets FDOT specifications. The availability of all of Florida's limestone deposits is diminished by urbanization, environmental restrictions, and public opposition to mining. All the available deposits in Florida are presently being mined. From the standpoint of quality and yield per acre, the Lake Belt is the most productive mining area in Florida. Alternate locations in the State could not replace Lake Belt production.

The analysis of alternatives is the heart of the EIS process. But alternatives can only be considered if they are "practicable". The EPA 404(b)(1) guidelines for wetland

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permitting provide a multipart test to determine whether alternatives are practicable in light of overall project purposes, i.e., providing rock meeting FDOT specifications for building and maintaining Florida's public and private infrastructure. For the purpose of evaluating Lake Belt alternatives, some of the factors are:

- The quality of the rock must meet FDOT standards
- The yield per acre. (The less yield per acre the greater the habitat impacts per ton of aggregate.)
- The habitat impacts of mining in the alternate location relative to mining in the Lake Belt.
- The effect on wetlands
- Cost
- Technology
- Logistics, including transportation issues
- Other significant environmental consequences of the alternative

These criteria were used to evaluate mining alternatives in Florida, other states, and in foreign countries. We also evaluated substitute materials and recycling. The results of the analysis show :

- There are extremely limited reserves of construction grade rock in Florida outside of the Lake Belt. Alternate sources in Florida are being fully utilized and are inadequate to replace any portion of Lake Belt rock.
- Alternate Florida sites have a substantially lower yield of useable rock per acre than the Lake Belt. Therefore, at these alternative sites, much more habitat needs to be disturbed to produce an equivalent quantity of rock.
- In general, the available alternate sites in Florida are in wetland/upland complexes with higher habitat value than the drained and degraded *Melaleuca* infested mining areas in the Lake Belt.
- Alternate sites in Florida lack adequate transportation infrastructure to serve the Lake Belt market area.
- Alternate sites in Florida are limited by public acceptance, urbanization, and the need for environmental permits.
- Alternate sites in other States have extreme logistical and cost problems. Rail or highway transportation infrastructure does not

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exist to move large quantities of rock to Florida. They are also in valuable habitat areas and have problems with urbanization and environmental permits.

- Alternate sites in foreign countries also have extreme logistical and cost problems. Rail served deep water port facilities to handle large volumes of rock do not exist in Florida. Port facilities in foreign countries can not be expanded to handle large volumes of rock. Potential quarries in Mexico, Nova Scotia, and the Bahamas are in valuable habitat areas. Rock from Mexico is produced in an extremely valuable subtropical rain forest. Rock from the Bahamas does not meet FDOT specifications due to high chloride content. Rock from Nova Scotia is only available 7 months per year due to weather.
- Technology does not exist for the use of alternate (non-quarry) materials to replace Lake Belt rock.

Based on federal criteria, there are no practicable alternatives to mining in the Lake Belt. Premature curtailment of Lake Belt mining would cause extreme disruption of Florida's construction industry and would vastly increase the cost of essential public and private infrastructure.

# **Analysis of the "Practicability" of Non-Lake Belt Alternative Sources to Supply Florida's Demand for Basic Construction Materials**

## **Introduction**

In 1999, the U.S. Army Corps of Engineers prepared a draft Environmental Impact Statement for limestone mining in the Miami-Dade County Lake Belt Area. This area presently supplies approximately one half of the crushed stone needed to build essential infrastructure in Florida. The Lake Belt Plan calls for continued mining in degraded wetlands for the next fifty years. Commentors to the EIS have questioned whether there are alternative sources of construction materials that could substitute for a portion of Lake Belt rock, thus avoiding some of the mining. This report evaluates the supply and demand for Lake Belt rock in the context of the Statewide supply and demand for these basic construction materials. Then, using the definition provided by the EPA 404(b)(1) Guidelines for wetland permitting, the report evaluates the "practicability" of Lake Belt alternatives.

## **Background**

Lake Belt mining began in the 1950s and has been approved by all necessary local, state and federal, zoning, planning, and permitting agencies. In 1992 the State of Florida created the Northwest Dade County Freshwater Lake Plan Implementation Committee to develop a comprehensive plan for the continuation of mining for another 50 years in the area known as the Lake Belt, recognizing the environmental, water resource and economic importance of the area. The Committee evaluated various alternatives for five years between 1992 and 1997.

Alternative mining scenarios were also reviewed by a special Federal Issue Team appointed by the South Florida Ecosystem Restoration Working Group. Since 1997, the Issue Team's recommendations have formed the basis for including the Lake Belt in the Restudy design team's Everglades restoration plans.

The unique value of Miami-Dade County limestone has long been recognized. The mining industry is concentrated in the Lake Belt area because of the large, accessible deposits of usable rock and the actions by state and local governments over the past 40 years. Beginning in the 1950s, the Dade county government recognized that quarry products generated by the mining industry were an essential element in the continued development of south Florida.

The large scale industrial activity associated with mining, processing and shipping rock products, and the manufacture of cement, required that the industry be located away from urban areas and near a secure source of limestone. Government decisions in the

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following decades established the industry in the location now designated as the Lake Belt. As recently as the 1970s, Dade County granted specific zoning approvals for limerock mining in areas now designated as the Pennsuco Wetlands and the Everglades National Park Expansion Area. In the Lake Belt Plan these approved mining areas have been abandoned and are now important wetland preservation and restoration areas.

In arriving at the recommendations in the EIS, the Corps built on the work of the State and Federal Lake Belt Committees and decisions of the Miami-Dade County Government, the Florida Legislature and the Federal Working Group. All these agencies balanced environmental protection with the State's critical need for rock to build public infrastructure such as roads, airports, schools and hospitals. They also recognized that a reliable source of quarry products will be needed for Everglades restoration and rebuilding the Lower East Coast's urban core near the coast, in addition to providing the ongoing infrastructure needs of a growing state.

Appendix B shows that annually, national use is approximately 2.8 billion tons of quarry products for construction purposes. At an average of 1.4 tons per cubic yard (net) this requires the mining of 2.0 billion cubic yards of rock to meet the annual infrastructure needs of the nation. The value of this rock at the quarry is \$13.5 billion and with the assumption that transportation doubles the cost to the consumer, the nation pays \$27 billion each year for construction rock. But few people recognize that our society is dependent on crushed stone, sand and gravel, and cement. This is because personal use is very little, if any, and hardly anyone recognizes the indisputable connection between mining and the infrastructure that makes possible our way of life. But everyone recognizes, and perhaps even takes for granted, our concrete and asphalt highway system; concrete bridges, our concrete buildings and parking garages, the concrete slabs and concrete blocks we use to build our houses, schools, churches and hospitals, asphalt parking lots, the concrete pipes we use to move water and so on.

The typical formula for concrete is:

- one part cement (90% quarry product)
- three parts sand (100% quarry product)
- three parts aggregate (100% quarry product)
- enough water to make it flow

Therefore, concrete is approximately 98% quarry product. The recipe for asphalt is similar except petroleum binder is substituted for cement. Asphalt is approximately 95% quarry product. In addition, the foundation material under our roads is called "base" and consists of crushed stone which is 100% quarry product. In Florida, we annually need a

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total of approximately 120 million tons of crushed stone, sand and gravel, and cement. This is approximately 8 tons for each of Florida's 15 million residents, every year.

For example, one mile of four lane interstate highway typically requires approximately 80,000 tons of rock, one new six room house in Miami typically requires approximately 300 tons of rock including the fill necessary to raise the house to mandated flood elevations, the slab, the concrete block walls, the road and sidewalks leading to it, and the commercial and transportation infrastructure attributable to the dwelling. Rock products are essential and the mining necessary to produce them is indispensable.

Mining operators, public officials, consumers, and community residents no longer can remain independent of each other. All groups and individuals must work together to ensure the reliable supply of basic construction materials to build and maintain our infrastructure. Our way of life depends on it.

### **Avoidance and Minimization of Wetland Impacts within the Lake Belt and the Adjacent Everglades**

Since 1992, the Lake Belt Plan has undergone intense scrutiny with respect to its direct impact on wetlands and potential impact on the restoration of the Everglades. In reviewing the potential extent of mining, the Federal Issue Team made several significant recommendations that limit the area to be mined specifically to provide additional protection for the Everglades. These recommendations were adopted by the Federal Working Group and pursuant to Section 404, constitute actions to avoid and minimize adverse impacts. These included;

- no recommendation for mining in the Pennsuco Wetlands and the National Park expansion area,
- maintaining a half mile buffer between new mines and the L-30 and L-33 levees to eliminate increased seepage from the Water Conservation Areas, and
- making mining within one half mile of the Dade-Broward Levee contingent on the future acceptance of a plan to reduce impacts in the Pennsuco wetlands.

By "maximizing the efficient recovery of limestone", a stated goal of the original legislation, the Lake Belt plan encourages the most efficient recovery of rock that technology allows. This minimizes the area impacted per unit of rock resource recovered, and maximizes the mitigation fee per acre to fund acquisition and restoration of the Pennsuco wetlands.

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By mandating the avoidance of the most sensitive areas within the Lake Belt and utilizing the most efficient methodologies to minimize the total impact per ton of rock extracted from the quarries, the Lake Belt Plan contained in the EIS achieves the "avoidance" and "minimization" requirements set forth in the 1980 Section 404(b)(1) Guidelines.

### **Shortage of Construction Rock in Florida**

The USGS report, Circular 1110, 1993, "Natural Aggregate - Building America's Future", recognizes that "natural aggregate occurs where nature placed it, not necessarily where people need it." This USGS report describes the Florida Peninsula and the Gulf Coast as an area "where aggregate occurs in very limited quantities; large areas may be devoid of aggregate". Florida has the fourth largest population in the nation and is one of America's fastest growing regions. It also has an extremely limited supply of the basic construction materials needed to build and maintain the infrastructure required to support society. The remaining rock resource in Florida should be considered a vital commodity of critical concern. Useable aggregate reserves in Florida are estimated to last for only another 30 to 50 years, depending on location.

The September 1999, U.S.G.S. Mineral Industry Survey for Florida states: "The larger size limestone aggregates are becoming a limited resource in the state". The Lake Belt presently supplies 54 % of Florida's larger size limestone aggregates and as other FDOT approved mining areas in the state become depleted, Lake Belt rock will become even more crucial in supplying the State's construction needs.

In addition to the very limited geological resource in Florida, the availability of construction grade rock is further diminished by urbanization, environmental regulations, public resistance to mining, etc.

### **Transportation**

Rock is a relatively low priced, high volume, heavy commodity. The cost of transportation can easily exceed the cost of the rock at the quarry. Transportation over short distances is typically by truck, while longer distances require rail, barge or ship. In areas of the United States which have abundant high quality rock, quarries are always located near the areas where large volumes of rock are needed.

The infrastructure needs of Dade and southern Broward County are supplied by trucks directly from the Lake Belt quarries. Because of the shortage of quality rock in Florida, rock is shipped by rail from the primary source of supply, the Lake Belt, to Orlando (230 miles) and Jacksonville (350 miles). For example, both Disneyworld and Cape Kennedy were constructed from Lake Belt Rock. If rock of sufficient quality had been available in proximity to these large projects it would certainly have been used.

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Most of the Lake Belt rock that is shipped by rail is economically transported from south to north on the FEC Railroad which otherwise has traffic which is predominantly in the other direction, from north to south. The FEC tracks are located along the East Coast of Florida. Smaller quantities of Lake Belt rock are shipped on the CSX Railroad which runs through the central part of the State. A network of redi-mix concrete, asphalt plants, and distribution terminals are located along both railroads to supply the infrastructure needs of the Eastern  $\frac{2}{3}$  of peninsular Florida, all the way to Jacksonville.

The 404(b)(1) Guidelines for assessing "practicability" require consideration of the cost and logistics associated with alternatives. Therefore, not only the alternative source of rock but how that rock would be delivered to the end user, i.e., the alternative distribution system, must be considered. This includes consideration of the logistics and cost of rail shipments from other states that would require transfer of rail cars from one railroad to another. At present, small quantities of rock are delivered to Florida's Panhandle area from other States.

In the case of possible rock supply from foreign sources, the alternative distribution system must include port facilities and the transfer of product to rail lines. At present, small quantities of rock are delivered from foreign sources to the ports of Tampa and Jacksonville. Increase in volume would require significant expansion of existing port facilities or the construction of new port facilities.

### **Categories of Construction Rock**

The two major categories are (1) coarse and (2) fine aggregates with a dividing line of 3/16 inch. In general, concrete is one part cement, three parts sand (fine aggregate), and three parts coarse aggregate.

The USGS and the rock industry further classifies rock as (1) sand and gravel and (2) crushed rock.

Sand and gravel are naturally occurring materials. In Florida it had its origins in alluvial periods when gravel and sand were deposited in the panhandle area and along a major channel from Jacksonville through Central Florida that terminated near Ortona in Southwest Florida. In their north-south movement, these natural sands underwent a process of attrition so that they are finer in composition than natural sands in other areas of the country. Typically, the sands found in Central Florida contain lesser amounts of coarse particles than the material in Florida's northern deposits. The sand deposits in Florida supply a portion of the State's need for fine aggregates. Except in the western panhandle, there are essentially no gravel deposits in the state. Even in the panhandle, coarse aggregate needs are supplemented with gravel and crushed limestone from outside the state. Sand is washed and sorted into various construction sizes of fine aggregate by screening.

## **Analysis of the "Practicability" of Non-Lake Belt Alternative Sources to Supply Florida's Demand for Basic Construction Materials**

Crushed Rock is essentially the only source of coarse aggregate in the state. Solid limestone is fractured by explosives, and processed through a crusher. The material is then washed and sieved into various construction sizes of coarse and fine aggregate. The bulk of coarse aggregate quarry production consists of (1) material with a nominal size of 1 inch and (2) material with a nominal size of 3/8 inch. Fine aggregate (less than 3/16 inch) is also called "manufactured sand".

Depending on location, the crushing process results in a variable mix of fine material (manufactured sand), and coarse aggregates. The ratio varies from mine to mine. There is no way to produce coarse aggregates without also producing fine aggregates.

### **Quality Considerations**

The following is taken from the USGS Circular 1110, "Natural Aggregate -- Building America's Future", 1993, Page 6, a discussion of the "Physical and Chemical Requirements of Aggregate".

"Most people probably assume that aggregate is used chiefly in cement concrete. Much natural aggregate, however, is unsuitable for such use. We all have seen crumbling driveways and bridges or cracks in sidewalks and patios. Concrete deterioration has many causes, but unsuitable aggregate, containing deleterious ingredients, can be a primary or secondary cause of the problem.

Natural aggregate varies widely in quality, depending on the source. To ensure that aggregate is suited for particular uses, testing laboratories compare aggregate properties with predetermined standards. The most generally used national guidelines for specification and testing procedures are those of the American Society for Testing and Materials (ASTM). National specifications must be broad, and at best they serve as general guidelines. Local specifications need to reflect specific uses, availability and quality of local aggregates, and local climatic conditions.

Suitable aggregate consists of clean, uncoated particles of proper size and gradation, physical soundness, hardness and strength, and chemical properties. The final use of the aggregate determines the specific properties sought. Generally, specifications for aggregate used in cement concrete and bituminous [asphalt] mixes are more stringent than are those for other construction-related uses.

Mechanical sieving or screening is used to grade, or sort to size, aggregate. In general, aggregate for cement concrete should be well graded throughout the sand and gravel range of particle sizes, although gap grading (aggregate with specific particle sizes missing) may be used and may be necessary for some products. Specifications for

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bituminous mixes are dependent on the pavement design, and therefore no general statement can be made regarding the sizes of aggregate used.

Particle shape affects both the grading limits of aggregate used in cement concrete and the workability of the concrete. The presence or excessive amount of angular particles can require addition of a greater percentage of sand to the mixture, which in turn requires more water and cement. In contrast, because inter granular contact provides strength in bituminous mixes, angular particles generally are desirable. Smooth particles offer little assistance in holding the aggregate in place in bituminous mixes, too many flat or long particles may be harmful.

Physical soundness is the ability of aggregate to resist weathering, particularly freezing-thawing and wetting cycles. Generally, aggregate that contains weak, easily broken, absorptive, or swelling particles is not suitable. Specifications for physical soundness are similar for use in cement concrete and bituminous mixes.

Hardness and strength of aggregate affect the ability of the final product to resist mechanical breakdown. The breakdown of soft or weak particles during handling or mixing is deleterious in both cement concrete and bituminous mixes.

Ideally, the aggregate is an inert filler, and it should not change chemically once in place. However, some aggregate contains minerals that chemically react with or otherwise adversely affect the concrete or bituminous mixes. In cement concrete, these chemical processes are reactions between the aggregate and the cement, solution of soluble materials, or oxidation of constituents. In bituminous mixes, chemical factors may influence oxidation of the asphalt or strip the bituminous film from the aggregate.... "

In Florida, most aggregate suppliers participate in a statistical quality control program developed by the Florida Department of Transportation (FDOT). The main purpose of frequent testing is to alert the producer to possible fluctuations in aggregate quality so that prompt adjustment can be made.

The data are submitted to the FDOT. Status as an approved FDOT quarry depends on continuing compliance with State standards. Quarry operations are routinely monitored through on-site FDOT inspections of compliance with quality control requirements. This process assures that our highways are built and maintained with high quality materials. In addition, specifiers of rock for private, non-government projects can assure high quality of aggregates by requiring these be supplied from FDOT approved quarries.

### **Florida's Demand for Rock**

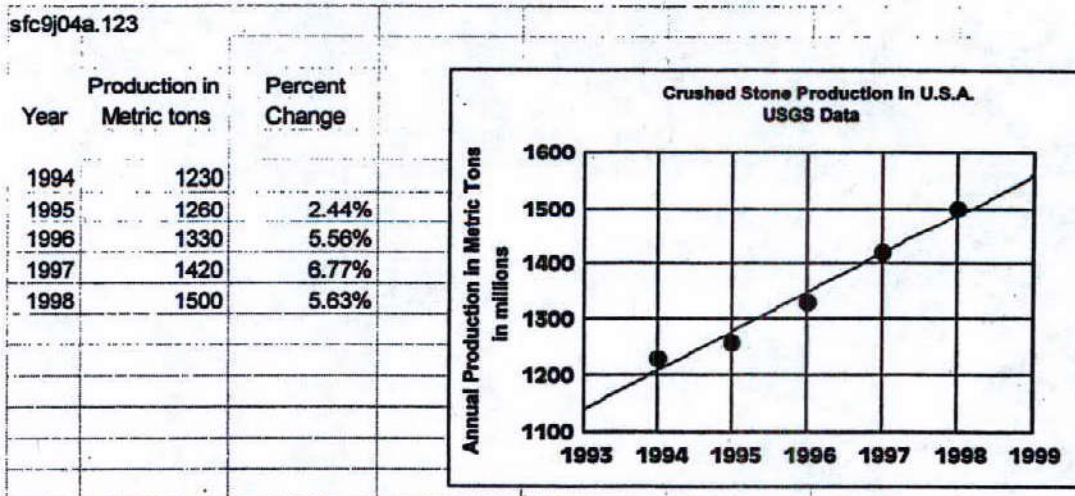
The U.S. Bureau of Mines monitors the production of aggregate. One purpose of this monitoring is to provide data that can be used to project future needs. Because crushed

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stone and sand and gravel are used mostly in the construction industry, reasonable estimates of the future demand for aggregate are based on predictions of future construction, such as the number of residential and nonresidential buildings, highway award contracts, and public construction products. Other factors commonly used to predict future aggregate production include population, employment, personal income, mortgage rates, and State or National gross domestic product.

Florida is a growth state and accommodating growing population requires large quantities of rock. In addition, existing infrastructure must be maintained and replaced from time to time. Government policy is redirecting growth away from urban fringes toward the city center. Such redevelopment will require substantial quantities of rock. An estimate of the rate of growth in demand in Florida is provided by USGS data for the United States. See Table 1. Growth in Florida is expected to exceed national projections. In addition, the restoration of the Everglades will be a massive public works project that will require large quantities of quarry products.

**Table 1**  
**Annual increase in Crushed Stone Production in U.S.A.**



The following Table 2, provides the distribution of rock produced and used in Florida in 1998. This illustrates the demand and supply in the State. Lake Belt Production is shown as a separate category. The data from this table was obtained from U.S.G.S. publications and from mining industry sources.

Table 2 - Distribution of Rock Produced and Used in Florida in 1998

	Tons* From Other States	Tons* From Foreign Sources	Tons* From Other Florida	Tons* From Lake Belt	Total Tons* Produced in Florida	Total Tons* Used in Florida
<b>Crushed Stone</b>						
Coarse (Aggregate)	1,000,000	1,300,000	16,000,000	21,100,000	37,100,000	39,400,000
Fine (Aggregate)	200,000	0	6,800,000	7,800,000	14,600,000	14,800,000
Road Base	250,000	0	19,200,000	6,800,000	26,000,000	26,250,000
Other	0	0	2,500,000	2,500,000	5,000,000	5,000,000
Cement**	0	6,000,000	4,500,000	2,800,000	7,300,000	13,300,000
Sub Total	1,450,000	7,300,000	49,000,000	41,000,000	90,000,000	98,750,000
<b>Natural Sand and Gravel</b>						
Coarse (Gravel)	100,000	0	40,000	0	0	140,000
Fine (Sand)	150,000	0	22,200,000	0	22,200,000	22,350,000
Other	0	0	0	0	0	0
Sub Total	250,000	0	22,240,000	0	22,200,000	22,490,000
Grand Total	1,700,000	7,300,000	71,240,000	41,000,000	112,200,000	121,240,000

\* Short tons (2,000 pounds)

\*\* As limestone equivalent, i.e., it takes approximately 1.8 tons of limestone to make one ton of cement

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### **Florida's Supply of Rock**

The FDOT maintains a data base of approved quarries in Florida, other states, and in foreign countries. Table 3 provides a listing of all DOT approved rock facilities in the state. Table 3, has been sorted to group quarries that supply crushed stone, sand, terminals where rock is distributed -- primarily from the Lake Belt, and quarries that supply road base but are not approved to supply sand or coarse crushed stone.

Figure 1 shows all DOT approved facilities, Figure 2 shows the location of approved crushed stone operations, Figure 3 shows the location of terminals where rock, primarily from the Lake Belt, is distributed to other parts of the State, and Figure 4 shows the location of facilities that produce only road base as the material generally does not meet State specifications for sand and gravel or crushed stone. Note that many of the crushed stone operations shown in Figure 2, also produce road base that meets DOT specifications. Figure 5, shows the location of sand mines, most are on the sand ridge that follows the center of the State. These facilities generally do not produce any coarse aggregate material.

Table 4 provides a listing of DOT approved quarries in other states. Seventeen of 32 facilities supply crushed stone. Quarries in northern Georgia supply crushed granite, the others, crushed limestone.

Table 5 provides a listing of DOT approved quarries in foreign countries. Quarries in Nova Scotia supply crushed granite, in Mexico, crushed limestone. Bahamian coarse crushed stone is not approved due to unacceptable chloride levels in the rock.

Table 2, above, shows the various quantities of basic construction materials presently supplied to meet Florida's needs. Please note the Lake Belt presently supplies approximately 1/2 of the crushed stone used in the State.

### **Assessing the practicability of alternate sources to replace Lake Belt rock.**

According to the EPA 404(b)(1) Guidelines for wetland permitting, "practicability" is determined according to the following multipart test:

- alternatives must have less adverse impact on the aquatic ecosystem
- alternatives must not have other significant environmental consequences
- practicability must consider cost, existing technology, and logistics in light of overall project purposes.

Table 2 shows the critical quantity of crushed stone that is supplied by the Lake Belt Area. This is the primary source of coarse aggregates for the State. Crushed stone (coarse aggregates) comprise approximately 1/2 of the volume of concrete and asphalt. For these

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end products to be durable and perform as planned, the coarse and fine aggregates must conform to FDOT specifications.

The Lake Belt produces approximately  $\frac{1}{2}$  of the crushed stone, coarse aggregate and manufactured sand, used in the entire state. As mentioned previously, concrete and asphalt requires a gradation of sand sizes. These graded sizes and angular particles result from the sieving process of producing manufactured sand. Fine aggregates (manufactured sand) are produced as a byproduct of the crushing process used to create coarse aggregates.

The sand mines shown in Figure 5 produce material with very small rounded particles that generally must be blended with manufactured sand for many applications, i.e., manufactured sands from the Lake Belt and other crushed stone facilities in the state can not be replaced by Florida's natural sands.

The only source of coarse aggregates in the state that meet FDOT standards are the Lake Belt and other crushed limestone facilities. Although construction grade rock is generally in short supply in Florida compared to other parts of the Country, it is coarse aggregate that is in critical short supply. Therefore, evaluation of alternatives needs to focus on crushed stone. Florida's existing crushed stone operations are shown on Figure 2. These generally coincide with areas on the map showing, "Areas of Potential Development of Limestone" from the 1979 report prepared by the Bureau of Geology, Florida Department of Natural Resources, Report of Investigations No. 88, "The Limestone, Dolomite and Coquina Resources of Florida". See Figure 6. Please note that some of the areas identified on Figure 6, as areas of potential development of limestone, do not produce material that meets FDOT specifications for coarse and fine aggregate for concrete and asphalt. For example, potential limestone areas in Suwannee, Alachua, Marion, and Sumter Counties, produce base material, but the quality of the material does not meet FDOT standards for aggregate.

All potential areas for the production of aggregates that will meet FDOT standards are presently being mined. Please see Figure 2 and Figure 6. These are:

1. The Dade County Lake Belt Area including Broward County
2. South East Dade County
3. Palm Beach County
4. The formation in Charlotte, Lee and Collier Counties
5. The Brooksville Area in Hernando County
6. Citrus County and Levy County Area

## **Analysis of the "Practicability" of Non-Lake Belt Alternative Sources to Supply Florida's Demand for Basic Construction Materials**

### **7. Taylor County Area**

### **8. Jackson County Area (very small production - not evaluated in Appendix)**

In Appendix A we evaluate each area and assess its potential to increase production as an alternative to Lake Belt Mining. The EPA 404(b)(1) guidelines for wetland permitting provide a multipart test to determine whether alternatives are practicable in light of overall project purposes. The factors include:

1. The quality of the rock pursuant to FDOT standards
2. The yield per acre. The less yield per acre the greater the habitat impacts per ton of aggregate.
3. The habitat impacts of mining in the alternate location relative to mining in the Lake Belt.
4. Effect on wetlands
5. Cost
6. Technology
7. Logistics, including transportation issues
8. Other significant environmental consequences

The same analysis is carried out for rock from other states and from foreign countries as follows:

1. Alabama
2. Georgia
3. Nova Scotia
4. Bahamas
5. Mexico

Individual analysis sheets for each quarry area are provided in Appendix A.

### **Practicable Technological Alternatives**

At this time, we know of no practicable technological alternatives to Lake Belt rock, and none have been suggested.

## **Analysis of the "Practicability" of Non-Lake Belt Alternative Sources to Supply Florida's Demand for Basic Construction Materials**

### **Conclusion**

The 404(b)(1) criteria were used to evaluate mining alternatives in Florida, other states, and in foreign countries. We also evaluated substitute materials and recycling. The results of the analysis show :

- There are extremely limited reserves of construction grade rock in Florida outside of the Lake Belt. Alternate sources in Florida are being fully utilized and are not adequate to replace any portion of Lake Belt rock.
- Alternate sites have a substantially lower yield of useable rock per acre than the Lake Belt. Therefore, at these alternate sites, much more habitat must be disturbed to produce an equivalent quantity of rock.
- In general, the available alternate sites in Florida are in wetland/upland complexes with higher habitat value than the drained and degraded Melaleuca infested mining areas in the Lake Belt.
- Alternate sites in Florida lack adequate transportation infrastructure to serve the Lake Belt market area.
- Alternate sites in Florida are limited by public acceptance, urbanization, and the need for environmental permits.
- Alternate sites in other States have extreme logistical and cost problems. Transportation infrastructure does not exist to move large quantities of rock to Florida. They are also in valuable habitat areas and have problems with urbanization and environmental permits.
- Alternate sites in foreign countries also have extreme logistical and cost problems. Rail served deep water port facilities to handle large volumes of rock do not exist in Florida. Port facilities in foreign countries can not be expanded to handle large volumes of rock. Potential quarries in Mexico, Nova Scotia, and the Bahamas are in valuable habitat areas. Rock from Mexico is produced in an extremely valuable subtropical rain forest. Rock from the Bahamas does not meet FDOT specifications due to high chloride content. Rock from Nova Scotia is only available 7 months per year due to weather. Foreign sites are not practicable alternatives to the Lake Belt.
- Technology does not exist for the use of alternate (non-quarry) materials to replace Lake Belt rock.

Based on federal criteria, there are no practicable alternatives to mining in the Lake Belt. Premature curtailment of Lake Belt mining would cause extreme disruption of

**Analysis of the "Practicability" of Non-Lake Belt Alternative Sources  
to Supply Florida's Demand for Basic Construction Materials**

Florida's construction industry and would vastly increase the cost of essential public and private infrastructure.

A. PRODUCT by COUNTY	MINE NAME	OWNER	MINE #	COUNTY	P	R	O	D	U	C	T
DOT					Road Base	Sand	Gravel	Crushed Stone (coarse)	Crushed Stone (fine)	Other (e.g. rip rap, ditch lining)	Cement (not on - Terminal Only)
DATA											
POINT											
5	GKK INC	PALM BEACH AGGREGATES INC	93406	PALM BEACH	X			X	X	X	
12	WHITE ROCK QUARRIES	WHITE ROCK QUARRIES	87338	DADE	X			X	X		
17	PENNSUCO QUARRY	TARMAC FLORIDA INC	87145	DADE	X			X	X		
19	FEC QUARRY	RINKER MATERIALS CORP	87090	DADE	X			X	X		
20	KROME QUARRY	RINKER MATERIALS CORP	87089	DADE	X			X	X		
22	CARD SOUND ROAD PIT	FLORIDA ROCK & SAND CO INC	87063	DADE	X			X	X		
23	GOLDEN PRINCE QUARRY	FLORIDA ROCK INDUSTRIES INC	87049	DADE	X			X	X		
26	HOLLYWOOD BLVD PIT	L W ROZZO INC	86139	BROWARD	X			X	X		
50	WHITE CONST CO CABBAGE GROVE 2	LIMEROCK IND INC	38036	TAYLOR	X			X	X	X	
93	ALICO PLANT	HARPER BROTHERS INC	12280	LEE	X			X	X		
94	FT MEYERS PLANT	FLORIDA ROCK IND INC	12008	LEE	X			X	X		
114	WILLOW RUN QUARRY	SOUTHERN SAND AND STONE	3340	COLLIER	X			X	X		
7	STAR RANCH MINE	BERGERON LAND DEVELOPMENT	93366	PALM BEACH				X	X	X	
14	UNION ROCK AND SAND CORP	CONTINENTAL AGGREGATES INC	87297	DADE				X	X		
47	RADCLIFF, CHATAHOOCHEE PLANT	MARTIN MARIETTA AGGREGATES	50120	GADSDEN				X	X		
49	CABBAGE GROVE MINING INC	CABBAGE GROVE MINING INC	38268	TAYLOR				X	X	X	
63	GULF HAMMOCK PIT	FLORIDA ROCK IND INC	34106	LEVY				X	X		
91	CORKSCREW QUARRY	YOUNGQUIST BROTHERS ROCK INC	12507	LEE				X	X		
105	GREGG PLANT	FLORIDA CRUSHED STONE CO	8012	HERNANDO				X	X		
106	VULCANICA	VULCANICA	8005	HERNANDO				X	X		
107	DIAMOND HILL MINE	FLORIDA ROCK IND INC	8004	HERNANDO				X	X		
118	GOLDEN GATE QUARRY, MACASPHALT	APAC	3017	COLLIER				X	X	X	
124	OLD LEE COUNTY SHELL/FILL	CORAL ROCK INC	1011	CHARLOTTE				X	X		
138	WHITE ROCK QUARRIES	WHITE ROCK QUARRIES	427	DADE				X	X		
28	GRANDIN SAND MINE	FLORIDA ROCK INDUSTRIES INC	76349	PUTNAM		X					
29	INTERLACHEN, KEUKA MINE	FLORIDA ROCK INDUSTRIES INC	76137	PUTNAM		X					
30	GOLDHEAD MINE	FLORIDA ROCK INDUSTRIES INC	71132	CLAY		X					
34	SIKES CONCRETE PIPE CO	SIKES CONCRETE PIPE CO	81377	WASHINGTON		X					
35	ANDERSON SAND INC	M & O SAND FILL & EQUIPMENT	81130	WASHINGTON		X					
36	CAMPBELL SAND	CAMPBELL SAND & GRAVEL CO	80418	WALTON		X					
37	MOSSY HEAD, ADAMS SAND CO	DIAMOND SAND CO	80128	WALTON		X					
45	CROWDER SAND	CROWDER EXCVTNG & LND CL INC	50471	GADSDEN		X					
48	QUINCY	ROBERTS SAND CO	50382	GADSDEN		X					
48	BLOUNTSTOWN SAND CO	ROBERTS SAND CO INC	47314	CALHOUN		X					
56	WEIRSDALE SAND	FLORIDA ROCK IND INC	36491	MARION		X				X	
61	MARION SAND CO	FLORIDA ROCK IND INC	36258	MARION		X				X	
82	JOSHUA MINE, STANDARD SAND & SILICA	CSR RINKER	16277	POLK		X					

CRUSHED STONE

SAND MINE

TABLE 3 - FDOT APPROVED ROCK FACILITIES IN FLORIDA

A PRODUCT by COUNTY	MINE NAME	OWNER	MINE #	COUNTY	P	R	O	D	U	C	T
DOT					Road Base	Sand	Gravel	Crushed Stone (coarse)	Crushed Stone (fine)	Other (e.g. rip rap, ditch lining)	Distribution Terminal Only
DATA POINT											
83	VULCANICA	VULCANICA	18081	POLK		X					
84	STANDARD SAND & SILICA	CSR RINKER	18078	POLK		X				X	
85	SANDLAND	FLORIDA ROCK IND INC	18077	POLK		X					
86	HAINES CITY PLANT	ER JAHNA INDUSTRIES INC	18024	POLK		X					
95	INDEPENDENT SAND MINE 474 NORTH	ER JAHNA IND INC	11490	LAKE		X					
96	INDEPENDENT MINE	ER JAHNA IND INC	11296	LAKE		X					
97	RINKER MATERIALS CORP	RINKER MATERIALS CORP	11283	LAKE		X					
98	CLERMONT MINE	FLORIDA ROCK IND INC	11067	LAKE		X				X	
99	CENTER SAND MINE	SILVER SAND CO CLERMONT INC	11064	LAKE		X					
100	ASTALLULA MINE	FLORIDA ROCK IND INC	11057	LAKE		X					
108	WITHERSPOON SAND, GLADES COUNTY	FLORIDA ROCK IND INC	5505	GLADES		X					
109	PALMDALE SAND PLANT	HARPER BROTHERS INC	5455	GLADES		X				X	
111	ORTONA MINE	ER JAHNA IND INC	5045	GLADES		X					
89	RECLAIMED CONCRETE CORP	GATOR ASPHALT PAVING	13395	MANATEE							X
125	DEFUNIAK SPRINGS	VULCAN MATERIALS	508	WALTON							X
126	LARGO TERMINAL	CONRAD YELVINGTON	500	PINELLAS							X
127	RIVERA BEACH REDISTRIBUTION TERM	CONRAD YELVINGTON DIST INC	492	PALM BEACH							X
128	CONRAD YELVINGTON DIST INC	CONRAD YELVINGTON	489	MARION							X
129	FLORIDA ROCK IND INC	FLORIDA ROCK IND INC	478	PASCO							X
130	EATON PARK REDISTRIBUTION TERM	CONRAD YELVINGTON DIST INC	473	POLK							X
131	TAFI REDISTRIBUTION TERMINAL	FLORIDA ROCK IND INC	469	ORANGE							X
132	VULCANICA	VULCANICA	465	MANATEE							X
133	CONRAD YELVINGTON DIST INC	CONRAD YELVINGTON DIST INC	462	BROWARD							X
134	RINKER MATERIALS CORP	RINKER MATERIALS CORP	447	BREVARD							X
135	RINKER MATERIALS CORP	RINKER MATERIALS CORP	445	DUVAL							X
136	TARMAC INC	TARMAC AMERICA INC	439	DUVAL							X
137	SHALIMAR TERMINAL	VULCAN MATERIALS CORP INC	429	OKALOOSA							X
139	PENDOLA POINT TERMINAL	VULCANICA	416	HILLSBOROUGH							X
140	DEBARY	CONRAD YELVINGTON DIST INC	407	VOLUSIA							X
141	ED AUSTIN TERMINAL	MARTIN MARIETTA	386	DUVAL							X
142	COASTAL MATERIALS OF ALABAMA	COASTAL MATERIALS OF ALABAMA	374	BAY							X
143	CONRAD YELVINGTON DIST INC	CONRAD YELVINGTON DIST INC	337	DUVAL							X
144	CONRAD YELVINGTON DIST INC	CONRAD YELVINGTON DIST INC	336	ORANGE							X
145	CONRAD DISTRIBUTORS	CONRAD YELVINGTON DIST INC	335	HILLSBOROUGH							X
146	MARTIN MARIETTA AGGREGATE TERM	MARTIN MARIETTA AGGREGATES	322	HILLSBOROUGH							X
147	VULCANICA	VULCANICA	313	HILLSBOROUGH							X
148	VALPRAISO TERMINAL	COASTAL MATERIALS OF ALABAMA	298	OKALOOSA							X

SAND MINE

TERMINALS  
(NO MINING)

TABLE 3 - FDOT APPROVED ROCK FACILITIES IN FLORIDA, CONTINUED

A. PRODUCT by COUNTY	MINE NAME	OWNER	MINE #	COUNTY	P	Road Base	R	Sand	O	Gravel	D	Crushed Stone (coarse)	U	Crushed Stone (fine)	C	Other (e.g. rip rap, ditch lining)	Q	Cement (not on - base)	T	Distribution Terminal Only
149	FLAMINGO DREDGE OPERATION	MARTIN MARIETTA AGGREGATES	155	WASHINGTON																X
1	BROWN RANCH MINE	STEWART MINING INC	94488	ST LUCIE			X													
2	NA	DICKERSON FLORIDA INC	94414	ST LUCIE			X													
3	FORT PIERCE MINE	FLORIDA ROCK INDUSTRIES INC	94209	ST LUCIE			X													
4	LOX ROAD QUARRY	RYAN INC EASTERN	93497	PALM BEACH			X													
8	KEYSQAQTE	THE REDLAND CO INC	87504	DADE			X													
9	TURKEY POINT FPL	THE REDLAND CO INC	87501	DADE			X													
10	RINKER SCL QUARRY	RINKER MATERIALS CORP	87428	DADE			X													
11	SUNSHINE ROCK INC	SUNSHINE ROCK INC	87343	DADE			X													
13	WESTWIND CONTRACTING INC	WESTWIND CONTRACTING INC	87300	DADE			X													
15	MIAMI CRUSHED ROCK INC	MIAMI CRUSHED ROCK INC	87284	DADE			X													
16	CUTLER PIT QUARRY	FLORIDA ROCK & SAND CO INC	87223	DADE			X													
21	RINKER LAKE QUARRY	RINKER MATERIALS CORP	87071	DADE			X													
24	TRIPLE R PAVING INC	TRIPLE R PAVING INC	86484	BROWARD			X													
31	BREVAR ROAD MATERIALS	BREVAR ROAD MATERIALS INC	70483	BREVAR			X													
32	BLACKHAWK QUARRIES OF FLORIDA	BLACKHAWK QUARRY CO OF FL	70278	BREVAR			X													
33	TRAWICK PIT	WHITE CONSTRUCTION CO INC	81391	WASHINGTON			X													
38	GRADED AGGREGATE BASE	ANDERSON COLUMBIA CO INC	58508	SANTA ROSA			X													
39	LANGWOOD IND	LANGWOOD IND	58465	LIBERTY			X													
40	GREEN VALLEY LIME	GREEN VALLEY LIME	53502	JACKSON			X													
41	IMPERIAL MINE	ANDERSON COLUMBIA CO INC	53390	JACKSON			X													
42	SINK CREEK MINE	DIXIE LIME PRODUCTS	53557	JACKSON			X													
43	JONES PIT MINE	WHITE CONSTRUCTION CO	53311	JACKSON			X													
44	ROCKY CREEK MINE	DOLOMITE INC	53271	JACKSON			X													
51	HATCH PIT	H R ELLINGTON CONST INC	37385	SUWANEE			X													
52	DENALI INC	DENALI INC	37304	SUWANEE			X													
53	LANIER PIT	ANDERSON MINING CORP	37112	SUWANEE			X													
54	SUWANEE MATERIALS & AGGREGATES	SUWANEE MATERIALS & AGGREGATE	37007	SUWANEE			X													
57	COUNTS CONSTRUCTION	COUNTS CONSTRUCTION CO INC	36477	MARION			X													
59	BEDROCK RESOURCES	BEDROCK RESOURCES	36356	MARION			X													
60	CLIFTON	WHITE CONSTRUCTION CO INC	36350	MARION			X													
62	M J STAVOLA IND	M J STAVOLA IND	36246	MARION			X													
64	V E WHITEHURST & SONS INC	V E WHITEHURST & SONS INC	34104	LEVY			X													
65	DENALI INC	DENALI INC	33496	LAFAYETTE			X													
66	DOWLING PARK	WHITE CONSTRUCTION CO INC	33493	LAFAYETTE			X													
67	DOWLING PARK PIT, ANDERSON	ANDERSON MINING CORP	33103	LAFAYETTE			X													
68	COLUMBIA CITY PIT	ANDERSON MINING CORP	29381	COLUMBIA			X													

BASE ONLY

A_PRODUCT_by_COUNTY	MINE NAME	OWNER	MINE #	COUNTY	P	R	O	D	U	C	T
DOT					Road	Sand	Gravel	Crushed	Crushed	Other	Distribution
DATA					Base			Stone	Stone	(e.g. rip	Terminal
POINT								(coarse)	(fine)	rap, ditch	Only
										(DOT data	
										base)	
70	COLUMBIA CITY MINE	LIMEROCK IND INC	29023	COLUMBIA	X				X		
71	NORTH FLORIDA LIMEROCK	NORTH FLORIDA LIMEROCK	28100	ALACHUA	X						
72	LIMESTONE PRODUCTS INC	LIMESTONE PRODUCTS INC	28099	ALACHUA	X					X	
73	NEWBERRY PIT	WHITE CONSTRUCTION CO	28088	ALACHUA	X						
74	WHITE CONSTRUCTION CO	WHITE CONSTRUCTION CO	28086	ALACHUA	X						
75	LIMESTONE PRODUCTS INC	LIMESTONE PRODUCTS INC	28002	ALACHUA	X						
76	HAILE QUARRY	LIMESTONE PRODUCTS INC	28001	ALACHUA	X						
78	BEDROCK RESOURCES	BEDROCK RESOURCES	18393	SUMTER	X						
79	CENTER HILL PLANT	FLORIDA CRUSHED STONE CO	18058	SUMTER	X						
80	COLEMAN #2	DOXE LIME & STONE CO	18058	SUMTER	X						
81	ST CATHERINE PIT	FLORIDA CRUSHED STONE CO	18020	SUMTER	X						
87	PLAZA MATERIALS CORP	PLAZA MATERIALS CORP	14282	PASCO	X						
88	SUN WEST MINE	SUN WEST MINE	14070	PASCO	X						
90	SMR AGGREGATES INC	QUALITY AGGREGATES	13276	MANATEE	X						
104	MILES MINE	E R JAHNA IND INC	8050	HERNANDO	X						
110	RIDGILL LIMEROCK MINE	RIDGILL & SON CONST INC	5354	GLADES	X						
112	FLORIDA ROCK & SAND CO INC	FLORIDA ROCK & SAND CO INC	3510	COLLIER	X						
113	SABAL PALM	SOUTHERN SAND AND STONE INC	3479	COLLIER	X						
115	COPELAND MINE	HARMON BROTHERS ROCK CO	3281	COLLIER	X				X		
116	NAPLES QUARRY	FLORIDA ROCK IND INC	3038	COLLIER	X				X		
117	SUNNILAND PIT	FLORIDA ROCK IND INC	3037	COLLIER	X						
119	INDEPENDENT AGGREGATES CORP	INDEPENDENT AGGREGATES CORP	2331	CITRUS	X						
120	COLITZ MINING CO, CRYSTAL RIVER	CRYSTAL RIVER QUARRIES INC	2018	CITRUS	X						
121	PENDING	QUALITY MINING INC	1511	CHARLOTTE	X						
122	CHARLOTTE COUNTY MINING MAT INC	CHARLOTTE COUNTY MINING MAT INC	1495	CHARLOTTE	X						
123	EARTHSOURCE INC	EARTHSOURCE INC	1305	CHARLOTTE	X						
25	MIRAMAR LAKES PIT	D'ELEGANCE MGT LTD INC	86451	BROWARD						X	
27	VULCAN BROWARD PLANT	D'ELEGANCE MGT LTD INC	86062	BROWARD						X	
55	BOUTWELL MINE	STATEWIDE MATERIALS	36999	MARION							
58	BOUTWELL CONSTRUCTION CO	BOUTWELL CONSTRUCTION CO	36394	MARION							
68	PENDING	PENDING	32470	HAMILTON							
77	L J STEPHENS TRANSP	STEPHENS TRANSP CO	18438	SUMTER						X	
82	STEPHENS CONST MAT CONT INC	STEPHENS CONST MAT CONT INC	12481	LEE							
101	STEPHENS TRANSP CO INC	STEPHENS TRANSP CO INC	8422	HERNANDO						X	
103	STEPHENS TRANSP CO INC	STEPHENS TRANSP CO INC	8381	HERNANDO						X	

BASE ONLY

OTHER

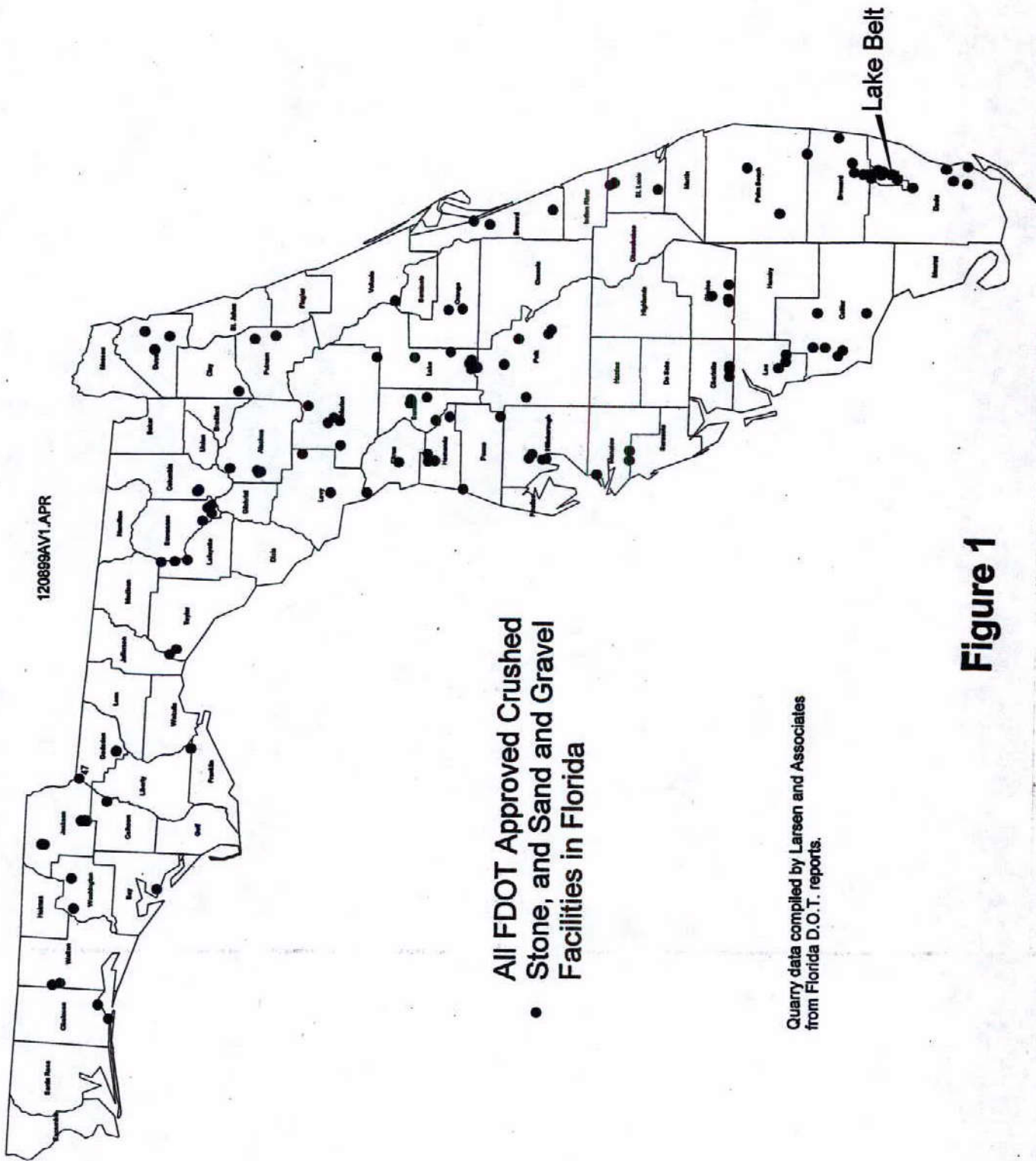
TABLE 3 - FDOT APPROVED ROCK FACILITIES IN FLORIDA, CONTINUED



CRUSHED  
STONE

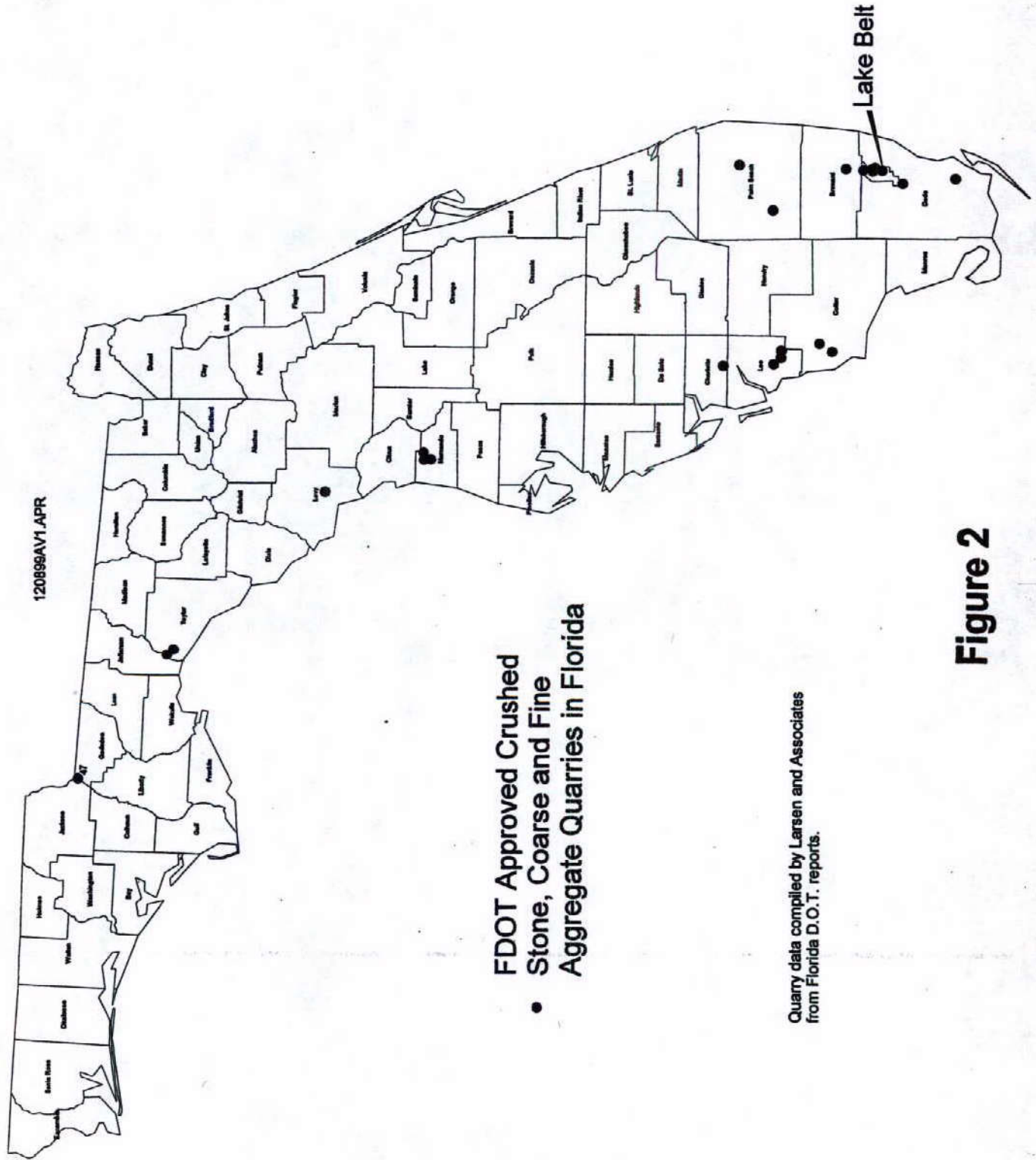
C. PRODBY	FOREIGN	OWNER	MINE #	COUNTRY	P	R	O	D	U	C	T	S
					Road Base	Sand	Gravel	Crushed Stone (coarse)	Crushed Stone (fine)	Other (e.g. rip rap, ditch lining)	Cement (not on - DOT data base)	Distribution Terminal Only
150	PORCUPINE MOUNTAIN QUARRY	MARTIN MARIETTA MATLS CANADA	315	NOVA SCOTIA				X	X			
151	ATLANTIC COAST MATERIALS INC	ATLANTIC COAST MATERIALS INC	509	NOVA SCOTIA				X	X			
152	SACTUN QUARRY	VULCAN MATERIALS CORP	411	MEXICO				X	X			
172	BRAVO BAHAMA ROCK QUARRY	MARTIN MARIETTA AGGREGATES	348	BAHAMAS	X				X	X		

TABLE 5 - FDOT APPROVED QUARRIES IN FOREIGN COUNTRIES



Quarry data compiled by Larsen and Associates from Florida D.O.T. reports.

**Figure 1**



**Figure 2**

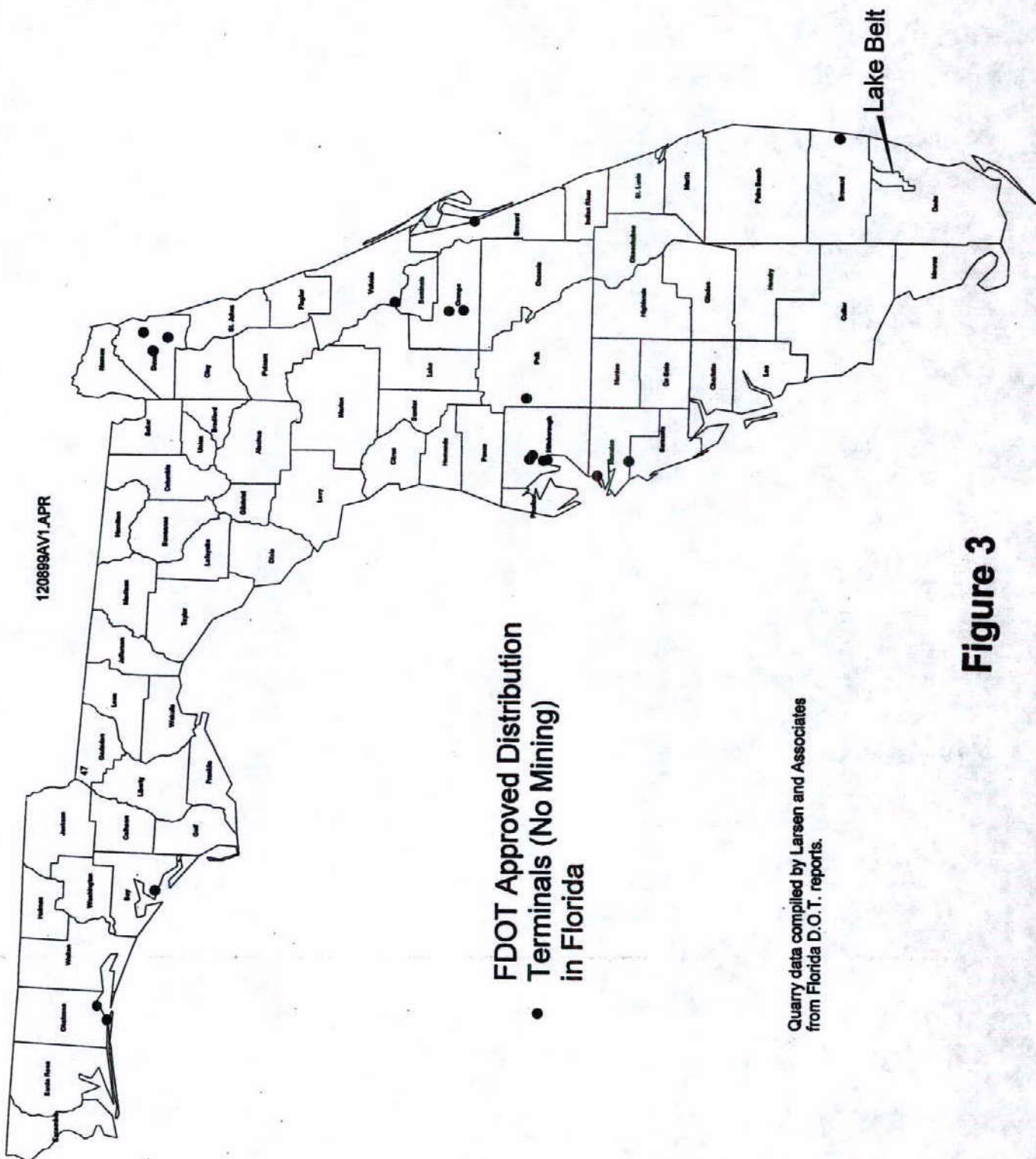
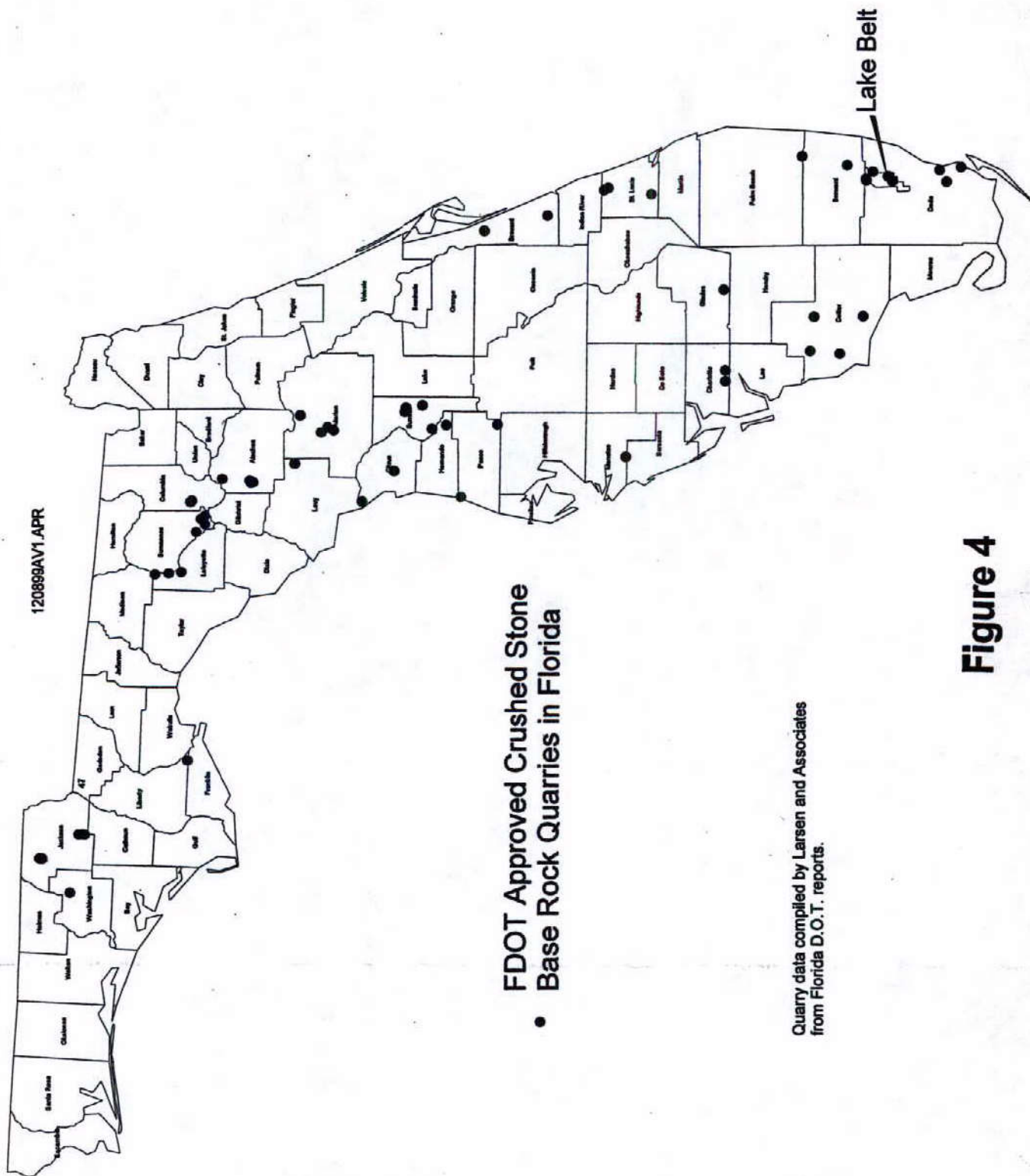
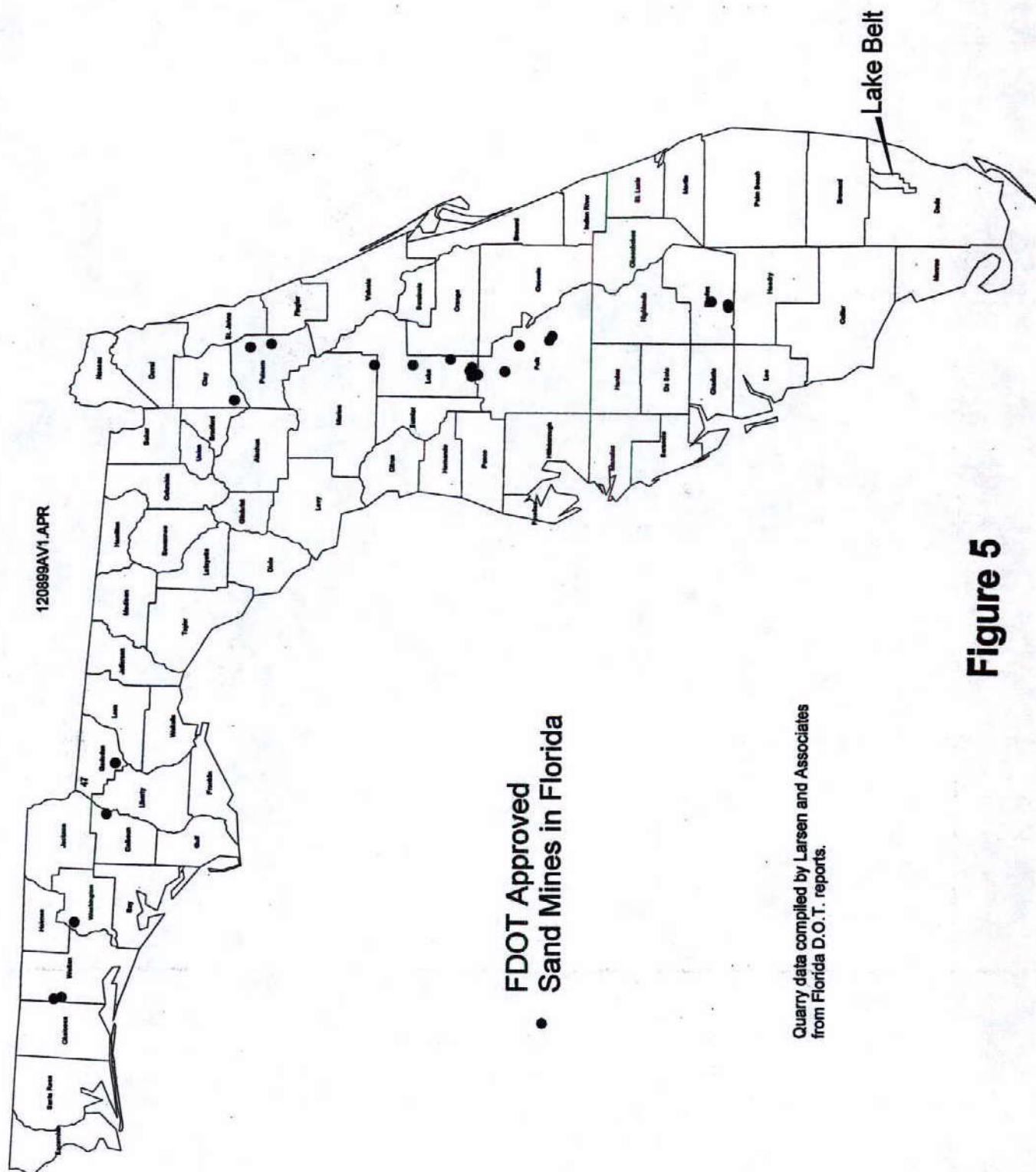


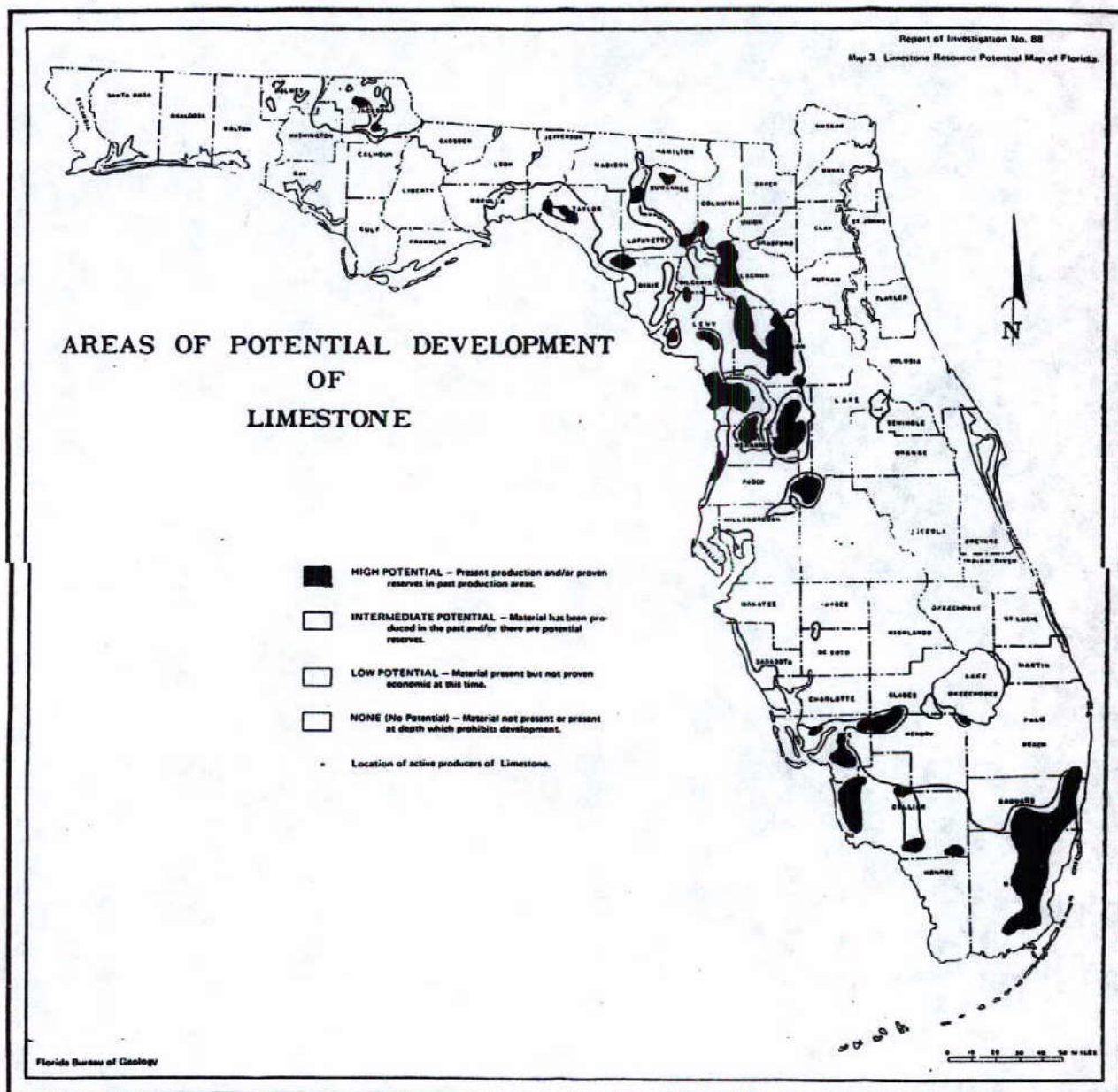
Figure 3



**Figure 4**



**Figure 5**



**Figure 6**

**Areas of Potential Development of Limestone from State of Florida,  
Bureau of Geology, Report of Investigations No. 88, The Limestone,  
Dolomite and Coquina resources of Florida**

**Emphasis Added to "High Potential" Areas.**

sfc9k14b.123

**Table 6 - Present Distribution of supply of Crushed Stone in Florida**

	Annual Production		Net Yield	FDOT Coarse Crushed Stone		FDOT Fine Crushed Stone		Roadbase & Other	Estimated Life
	net tons	tons/acre	%	net tons	%	net tons	%	net tons	Years
Florida									
Miami Lake Belt	41,000,000	125,000	51%	21,100,000	19%	7,800,000	30%	12,100,000	50
Broward County									0
Palm Beach County	3,500,000	32,000	40%	1,400,000	20%	700,000	40%	1,400,000	10
Naples Area	2,500,000	55,000	40%	1,000,000	20%	500,000	40%	1,000,000	5+
Lee County	9,000,000	32,000	60%	5,400,000	25%	2,250,000	15%	1,350,000	25
Brooksville**	9,000,000	40,000	60%	5,400,000	25%	2,250,000	15%	1,350,000	10
Levy County	3,000,000	42,000	50%	1,500,000	20%	600,000	30%	900,000	30+
Perry Area	2,500,000	45,000	50%	1,250,000	20%	500,000	30%	750,000	30+
All Others	15,000,000	na	0%	0	0%	0	100%	15,000,000	na
Total non-Lake Belt	44,500,000	na		15,950,000		6,800,000		21,750,000	na

\*\* does not include cement mills

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11. U.S.G.S. Mineral Industry Surveys for Florida, Arnold Tanner, September 1999, [<http://minerals.usgs.gov/minerals/>] and Walter Schmidt, State Geologist, [<http://www.dep.state.fl.us/geo/>]
12. Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, J. B. Lairscey, P.E., Ernest Garcia, P.E., 1996 and updated on [[www.dot.state.fl.us](http://www.dot.state.fl.us)] on November 13, 1999, See Sections 901- 911, Division III.

# APPENDIX

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## **APPENDIX A.**

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## 1. Limestone Quarries in Palm Beach County

Quality of Rock - Suitability for FDOT Coarse aggregate ... Quality is marginal and sometimes out of compliance with DOT standards.

Yield/Production of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand) .... Annual Production is approximately 3.5 million tons with a yield of approximately 32,000 tons per acre.  
Potential for expansion of operations

Additional extent of reserves ... limited, will last 10 years. This is a cap-rock deposit and constitutes a limited pocket of acceptable material.

Availability of land ... limited availability of material that meets DOT Specs

Potential for permits ... Difficult

Public Acceptance ... Accepted

Effect on wetlands ... This is a former wetland area, now drained as part of the EAA. This is former sugar cane land. . Yield is 26 % of Lake Belt. Therefore, 3.9 times as much land area is disturbed to produce the same amount of rock. The quarry leaves a lake

Habitat Value, whether uplands or wetlands, endangered species ... former wetlands, now drained by SFWMD.

Logistics, transportation issues ... Market is served only by trucks, site of deposit is not served by rail which would allow supply to more distant markets to replace Lake Belt Rock

Other Significant Adverse Environmental consequences of mining ... Water is required for washing and sorting rock. Ground water in this area is influenced by connate seawater which can affect quality to end user.

Market ... Competitive with Lake Belt in local market area served by truck

Summary ... Not practicable as Lake Belt alternative due to limited reserves, marginal quality, low yield and lack of rail access.

## 2. Limestone Quarries in Broward County

Quality of Rock - Suitability for FDOT Coarse aggregate ... Quality is good but contains greater percentage of sand than Miami-Dade County Lake Belt

Yield/Production of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand) .... Annual Production has declined to less than 1.0 million tons with a yield of approximately 100,000 tons per acre. Mining in Broward county was previously substantial, but now, Broward County receives its rock primarily from Miami- Dade County. Broward county has not been included in totals provided in Table 2.

Potential for expansion of operations

Additional extent of reserves ... None, mining has been replaced by urban development.

Availability of land ... No additional land available, mining is being phased out.

Potential for permits ... Extremely difficult in Broward county

Public Acceptance ... Public opposition based on blasting and environmental concerns.

Effect on wetlands ... This is a former wetland area, now drained for urban purposes. Yield is 80 % of Lake Belt. Therefore, 1.25 times as much land area is disturbed to produce the same amount of rock. The quarry leaves a lake

Habitat Value, whether uplands or wetlands, endangered species ... former wetlands, now drained by SFWMD and by Broward County.

Logistics, transportation issues ... Market is served only by trucks.

Other Significant Adverse Environmental consequences of mining ... Water is required for washing and sorting rock.

Market ... Competitive with Lake Belt in local market area served by truck. Most present mining is for the purpose of filling land for residential development.

Summary ... Not practicable as Lake Belt Alternative due to loss of essentially the entire resource to urban development which is a more profitable land use. No rail access.

### 3. Limestone Quarries in Miami-Dade County Lake Belt Area

Quality of Rock - Suitability for FDOT Coarse aggregate ... Meets all FDOT requirements for coarse and fine aggregate and for road base. Quality is sufficient for feed stock to Cement Mills. For construction purposes, Lake Belt rock is the best in the State.

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual production is approximately 40.0 million tons with a yield of approximately 125,000 tons per acre.

Potential for expansion of operations

Additional extent of reserves ... Reserves in the Lake Belt will last another 50 years

Availability of land ... Ownership by rock mining companies and lease lands owned by the State will support another 50 years of mining

Potential for permits ... Mining Permits will be issued for 50 years pursuant to the lake Belt Plan

Public Acceptance ... Plan approved by the Florida Legislature. Some homeowners are concerned over blasting vibrations.

Effect on wetlands ... All mining will occur in seriously degraded wetlands according to a mitigation plan approved by the Florida legislature, and local, state, and federal agencies.

Habitat Value, whether uplands or wetlands, endangered species All issues of wetland functions and values and habitat have been resolved by legislation dealing with mitigation.

Logistics, transportation issues ... Rock is shipped by rail to Orlando on the CSX Railroad and along the East Coast as far as Jacksonville on the FEC Railroad. Rock is delivered to terminals and to specific customers along both railroads. Rock is shipped to consumers in Dade and Broward counties by truck direct from the quarry and by truck to half of Florida from terminals located along rail lines

Other Significant Adverse Environmental consequences of mining ... None, large Volumes of water are available for processing of rock. Water is returned to the aquifer.

Markets ... The Lake Belt is a significant factor in holding down the cost of basic construction materials in Florida for both public and private construction.

Summary ... Approximately 50 years of mining remaining. This is a crucial state resource for supplying rock which is essential to building and maintaining public and private infrastructure in Florida. Rail access and truck access is good. This area supplies approximately 1/2 of Florida's crushed stone and serves a market area which extends to Orlando and Jacksonville.

## 4. Limestone Quarries in Naples Area

Quality of Rock - Suitability for FDOT Coarse aggregate ... Meets DOT requirements, however, very shelly with flat and elongated pieces

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual production is approximately 2.5 million tons with a net yield of approximately 55,000 tons per acre.

Potential for expansion of operations

Additional extent of reserves ... Reserves extremely limited, Miners selling land to developers.

Availability of land ... Additional land not available for mining. Mining area encroached by urban sprawl

Potential for permits ... Approvals for expanded mining extremely difficult to obtain, panther habitat, wetland/upland complex with high habitat value

Public Acceptance ... Public objects to additional mining

Effect on wetlands ... All mining will occur in wetland/upland complex deemed to be superior habitat compared to mining areas in the Lake Belt. Yield is 44 % of Lake Belt. Therefore, 2.3 times as much land area is disturbed to produce the same amount of rock. The quarry leaves a lake.

Habitat Value, whether uplands or wetlands, endangered species ... Excellent habitat. 2.3 times as much habitat is disturbed to produce the same amount of rock.

Logistics, transportation issues ... Transportation is by truck to local markets.

Other Significant Adverse Environmental consequences of mining ... None. Large volumes of water are available for processing of rock. Processing water is returned to the Aquifer.

Market ... Serves local market, this is not an area generally served by the Lake Belt, however, Lake Belt Rock supplies certain applications such as asphaltic friction courses which cannot be supplied locally.

Summary ... Not practicable as Lake Belt alternative due to limited resources, urban encroachment, sales of mining land for more profitable urban development, low yield compared to Lake Belt, high habitat value, difficulty of permit approvals and lack of rail access.

## 5. Limestone Quarries in Lee County Area

Quality of Rock - Suitability for FDOT Coarse aggregate ... Meets DOT requirements, and is comparable to Lake Belt Rock.

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual Production is approximately 9.0 million tons with a yield of approximately 32,000 tons per acre.

Potential for expansion of operations

Additional extent of reserves ... Reserves limited. Three quarry operation, two will run out of rock in 15 years, the third in 80 years at current mining rates. Mining rates at third quarry will increase when first two quarries stop production.

Availability of land ... Additional land not available for mining. Mining area encroached by urban sprawl

Potential for permits ... Approvals for expanded mining extremely difficult to obtain, panther habitat, wetland/upland complex with high habitat value

Public Acceptance ... Public objects to additional mining

Effect on wetlands ... All mining will occur in wetland/upland complex deemed to be superior habitat compared to mining areas in the Lake Belt. Yield is 26% of Lake Belt. Therefore, 3.9 times as much land area is disturbed to produce the same amount of rock. The quarry leaves a lake.

Habitat Value, whether uplands or wetlands, endangered species ... Excellent habitat. 3.9 times as much of this habitat area is disturbed to produce the same amount of rock as in the Lake Belt.

Logistics, transportation issues ... Transportation is by truck to local markets. there is no rail service which would allow supply to more distant markets to replace Lake Belt rock.

Other Significant Adverse Environmental consequences of mining ... None. Large volumes of water are available for processing of rock. Processing water is returned to the Aquifer.

Market ... Serves local market, this is not an area generally served by the Lake Belt, however, lake Belt Rock supplies certain applications such as asphaltic friction courses which cannot be supplied locally.

Summary ... Not practicable as Lake Belt alternative due to limited resource, urban encroachment, low yield compared to Lake Belt, high habitat value, difficulty of permit approval and lack of rail access.

## 6. Limestone Quarries in Brooksville Area ( Hernando County)

Quality of Rock - Suitability for FDOT Coarse aggregate ... Meets DOT requirements, however, is the most variable deposit in the state. The material will meet most Lake Belt quality parameters, but will not meet all criteria such as for certain high traffic level asphaltic pavements.

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual Production is approximately 9.0 million tons with a yield of approximately 40,000 tons per acre.

Potential for expansion of operations

Additional extent of reserves ... Reserves extremely limited Three quarry operations, two will run out of rock in 5 years, the third in approximately 15 years at current mining rates. Mining rates at third quarry will increase when first two quarries stop production.

Availability of land ... Additional land not available for mining. Mining area encroached by urban sprawl

Potential for permits ... Approvals for expanded mining extremely difficult to obtain, panther habitat, upland area with high habitat value

Public Acceptance ... Public objects to additional mining

Effect on wetlands ... None. However, yield of coarse aggregate is 32 % of Lake Belt. Therefore 3.1 times as much habitat is disturbed to produce the same amount of rock.

Habitat Value, whether uplands or wetlands, endangered species ... Excellent habitat

Logistics, transportation issues ... Transportation is predominantly by truck to local markets. Rail service is available but not widely used because of more competitive transportation by truck. Reserves are not adequate to support large scale rail use.

Other Significant Adverse Environmental consequences of mining ... Large volumes of rock are required for processing rock in an area that can be subject to droughts. Processing water is returned to the aquifer.

Market ... Serves Ocala to Tampa market, this is not an area generally served by the Lake Belt, however, Lake Belt Rock supplies certain applications such as asphaltic friction courses which cannot be supplied locally

Summary ... Not practicable as Lake Belt alternative due to extremely limited resource, low yield per acre compared to Lake Belt, high upland habitat value, and difficulty of permit approvals.

## 7. Limestone Quarries in Levy and Citrus Counties

Quality of Rock - Suitability for FDOT Coarse aggregate ... Meets some DOT requirements, however, is variable in hardness. Does not meet quality parameters of Lake Belt Rock for abrasiveness and specific gravity. Material is of marginal quality for certain high traffic level asphaltic pavements.

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual production is approximately 3.0 million tons with a yield of approximately 42,000 tons per acre.

Potential for expansion of operations

Additional extent of reserves ... reserves will last approximately 30 years at present mining rates.

Availability of land ... Additional land not available for mining.

Potential for permits ... Approvals for expanded mining extremely difficult to obtain. This is a wetland/upland complex.

Public Acceptance ... Public objects to additional mining

Effect on wetlands ... This is a wetland/upland complex with overall habitat values greater than the Lake Belt. However, yield of coarse aggregate is 48% of Lake Belt. Therefore, 2.1 times as much habitat is disturbed to produce the same amount of rock.

Habitat Value, whether uplands or wetlands, endangered species ... Excellent habitat

Logistics, transportation issues ... Transportation is by truck to local markets. There is no rail service which would allow supply to more distant markets to replace Lake Belt rock.

Other Significant Adverse Environmental consequences of mining ... None. Large volumes of rock are available for processing of rock. Processing water is returned to the aquifer.

Market ... Serves Gainesville - Ocala and local market, this is not an area generally served by the Lake Belt however, Lake Belt Rock supplies certain applications such as asphaltic friction courses which cannot be supplied locally.

Summary ... Not practicable as Lake Belt alternative due to limited resource, less than ideal quality, low yield per acre compared to Lake Belt, high habitat value, difficulty of permit approvals, and lack of rail access.

## 8. Limestone Quarries in Perry Area (Taylor County)

Quality of Rock - Suitability for FDOT Coarse Aggregate ... Meets DOT requirements for road base and fine aggregates but does not meet FDOT requirements for coarse aggregates.

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual production is approximately 2.5 million tons with a yield of approximately 45,000 tons per acre.

Potential for expansion of operations

Additional extent of reserves ... reserves will last approximately 30 years at present mining rates.

Availability of land ... Additional land not available for mining.

Potential for permits ... Approvals for expanded mining extremely difficult to obtain. This is a wetland/upland complex.

Public Acceptance ... Public objects to additional mining

Effect on wetlands ... This is a wetland/upland complex with overall habitat values similar to the Lake Belt. However, yield is 36 % of Lake Belt. Therefore, 2.8 times as much habitat is disturbed to produce the same amount of rock.

Habitat Value, whether uplands or wetlands, endangered species ... Excellent habitat

Logistics, transportation issues ... Transportation is by truck to local markets. There is no rail service which would allow supply to more distant markets to replace Lake Belt rock.

Other Significant Adverse Environmental consequences of mining ... Unknown. Processing water is returned to the aquifer.

Market ... Serves the local market of Tallahassee to Lake City.

Summary ... Not practicable as Lake Belt alternative due to limited resource, low yield per acre compared to Lake Belt, high habitat value, difficulty of permit approvals, and lack of rail access.

## 9. Granite Quarries in Northern Georgia

Quality of Rock - Suitability for FDOT Coarse aggregate ... High quality, granite. Concrete producers in Florida prefer limestone because particles have cementitious properties which improve concrete quality. In addition, granite is highly abrasive to concrete producing equipment and heavier to transport than limestone. Granite provides a very durable surface layer for asphalt, however, a lime slurry agent is needed as an anti stripping agent.

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual Production for entire State of Georgia for all crushed stone is 78.2 million tons. Sand and gravel production is 7.7 million tons. The percentage of this production that meets FDOT specification is not known, however, all Georgia coarse crushed stone that is approved by FDOT is located in North Georgia, north of a line extending from Columbus to Macon to Augusta. Yield is approximately 1 million tons per acre as mining consists of removing low mountains.

Potential for expansion of operations

Additional extent of reserves ... substantial additional reserves, limitations in some areas due to urban growth pressure

Availability of land ... Substantial additional land available

Potential for permits ... Extremely difficult and time consuming, Air quality issues of this mining in the dry are important

Public Acceptance ... Depends upon proximity to urban areas.

Effect on wetlands ... Upland area.

Habitat Value, whether uplands or wetlands, endangered species ... Habitat value of forested area is high, residual land is reclaimed to create wildlife habitat

Logistics, transportation issues ... Rail network is not adequate for redistribution to areas presently served by Miami-Dade Lake Belt area. Present production of quarries is presently delivered to existing customers. Present capacity of quarries is limited and large financial investments would be necessary to increase production above present levels to accommodate larger service area. Large financial investments would be required to provide distribution to areas now served by the Lake Belt.

Other Significant Adverse Environmental consequences of mining ... Air quality effects of dry surface mines are an issue.

Market ... Transportation costs to areas presently served by the Lake Belt would be very high. The cost for the infrastructure necessary for Georgia rock to replace Lake Belt rock in the Lake Belt service area would be extremely high and take years to implement.

Summary ... Not practicable as Lake Belt alternative due to extreme logistical and cost problems in moving material to present Lake Belt service area from Northern Georgia. Present rail facilities now operate near capacity and huge capital investment would be required to increase production and provide large scale distribution to Florida and present Lake Belt service area.

## 10. Limestone Quarries in Northern Alabama

Quality of Rock - Suitability for FDOT Coarse aggregate ... High quality, equivalent to Lake Belt

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual production for entire State of Alabama for all crushed stone is 50.2 million tons. Sand and gravel production is 16.0 million tons. The percentage of this production that meets FDOT specifications is not known, however, all Alabama coarse crushed stone that is approved by FDOT is located in northern Alabama. Yield is approximately 750,000 tons per acre as mining is of hills.

Potential for expansion of operations

Additional extent of reserves ... substantial additional reserves

Availability of land ... Substantial additional land available

Potential for permits ... Difficult

Public Acceptance ... Good, in rural areas

Effect on wetlands ... Upland area, mining occurs in the dry with pumps, when pumps are turned off, excavation fills with water.

Habitat Value, whether uplands or wetlands, endangered species ... Habitat value of forested area is high

Logistics, transportation issues ... Small quantities are presently shipped by rail and truck to Panhandle of northern Florida. All FDOT approved coarse aggregate locations are in northern Alabama. Rail facilities are inadequate to ship any large quantities to present Lake Belt service area.

Other Significant Adverse Environmental consequences of mining ... Unknown.

Market ... Transportation costs to areas presently served by the Lake Belt would be very high. The costs for the infrastructure necessary for Alabama rock to replace Lake Belt Rock in the Lake Belt Service Area would be extremely high and take years to implement.

Summary ... not practicable as Lake Belt alternative due to extreme logistical and cost problems in moving material to present Lake Belt service area from Northern Alabama. Present rail facilities now operate near capacity and huge capital investment would be required to increase production and provide large scale distribution to Florida and present Lake Belt service area.

## 11. Limestone Quarries in Yucatan Peninsula, Mexico

Quality of Rock - Suitability for FDOT Coarse aggregate ... Coarse Aggregate quality equal to Lake Belt

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual production is approximately 8.0 million tons with a yield of approximately 125,000 tons per acre.

Potential for expansion of operations

Additional extent of reserves ... All reserves owned by government of Mexico

Availability of land ... Additional land is available adjacent to operation

Potential for permits ... Now extremely difficult, Vulcan would not likely attempt additional permits.

Public Acceptance ... Unknown

Effect on wetlands ... None, upland area, mining occurs from 40 above, to 40 feet below the water table, creating lakes.

Habitat Value, whether uplands or wetlands, endangered species ... Subtropical Rain forest Area, project opposed by several environmental groups ... Mining converts Rain forest to freshwater lakes. There are extremely valuable archeological sites in this area which will make additional mining very difficult.

Logistics, transportation issues ... Small quantities are presently shipped to Tampa, distributed by truck. Most of present annual production of 8 million tons goes to other Gulf Coast ports in the Florida Panhandle, Alabama, Mississippi, Louisiana and Texas. Harbor facilities in Mexico can handle a maximum of 12,000,000 tons per year, this port facility can not be expanded. Port facilities in Florida with adequate depth, land to stockpile material, and rail access to customers are extremely limited. It would be difficult to expand existing port facilities in Florida; new facilities would be required. If new facilities were constructed, it is likely that the combination of depth, land, and rail could only be provided in Jacksonville, but, at great expense. Land is only available along the north side of the St. Johns River, on the CSX Railroad. There would be substantial difficulty in transfer to the FEC Railroad for deliveries to the East Coast of Florida.

Other Significant Adverse Environmental consequences of mining ... Hurricane stockpiles at port in Mexico could wash into harbor under Hurricane conditions.

Market ... Cost of limited quantities shipped to existing facility in Tampa is competitive with other sources in Tampa area. The Tampa area also receives small shipments from the Lake Belt. Costs for infrastructure necessary for Mexican rock to replace Lake Belt Rock in Lake Belt Service Area would be extremely high and take years to implement.

Summary ... Not practicable as Lake Belt alternative due to extreme logistical and cost problems in moving material by vessel, unloading in Florida port, and rail transport to Lake Belt service area. Capacity of quarry and port facility in Mexico is limited.

## 12. Granite Quarries in Nova Scotia

Quality of Rock - Suitability for FDOT Coarse aggregate ... High quality, granite. Concrete producers in Florida prefer limestone because particles have cementitious properties which improve concrete quality. Granite provides a very durable surface layer for asphalt, however, a lime slurry agent is needed as an anti stripping agent.

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual production is approximately 2.5 million tons with a yield of approximately 1,000,000 tons per acre as mining consists of removing low mountains.

Potential for expansion of operations

Additional extent of reserves ... essentially unlimited

Availability of land ... essentially unlimited

Potential for permits ... Very Good

Public Acceptance ... Very Good

Effect on wetlands ... Upland area,

Habitat Value, whether uplands or wetlands, endangered species ... Habitat value of forested area is high, residual land is reclaimed to create wildlife habitat

Logistics, transportation issues ... Material can only be produced for 7 months each year, Shipping occurs 12 months per year, however, Port Area in Halifax can only accommodate 5 vessels during the five month winter. During particularly cold times, the stockpiles freeze. Port facilities in Florida with adequate depth, land to stockpile material, and rail access to customers are extremely limited. It would be difficult to expand existing port facilities in Florida, new facilities would be required. If new facilities were constructed, it is likely that the combination of depth, land, and rail could only be provided in Jacksonville, but, at great expense. Land only available along north side of St. Johns River, on CSX Railroad, creating difficulty in transfer to FEC Railroad for East Coast of Florida.

Other Significant Adverse Environmental consequences of mining ... Expansion of production would require reclaiming land and filling Halifax stockpile area out into the water.

Market ... Essentially all production is now delivered to various East Coast ports including small quantities delivered to the port of Tampa. Costs for infrastructure necessary for Nova Scotia rock to replace Lake Belt rock in the Lake Belt service area would be extremely high and would take years to implement.

Summary ...Not practicable as Lake Belt alternative due to extreme logistical and cost problems in moving material by vessel, unloading in Florida port, and providing rail transport to Lake Belt service area. Port facility in Nova Scotia is limited. Huge capital investment would be required to increase production and provide large scale distribution to Florida and present Lake Belt service area. Due to weather, quarries can operate only 7 months per year, demand in Florida is on 12 month basis.

### 13. Limestone Quarries in Freeport, Bahamas

Quality of Rock - Suitability for FDOT Coarse aggregate ... Currently not certified by DOT due to Chloride content in rock. This negatively affects the durability and strength of concrete

Yield of Rock - Coarse Aggregate and Fine Aggregate (Manufactured Sand)

Annual production is approximately 1.8 million tons with a yield of approximately 100,000 tons per acre.

Potential for expansion of operations

Additional extent of reserves ... limited, this is a small island

Availability of land ... limited

Potential for permits ... Difficult

Public Acceptance ... Accepted

Effect on wetlands ... Upland area, but creates lake after mining

Habitat Value, whether uplands or wetlands, endangered species ... unknown

Logistics, transportation issues ... Rock is shipped by barge and can be delivered to smaller ports in Florida. End user can be supplied by truck. Port facilities in Freeport are shared with others and it is doubtful that exports could be expanded significantly.

Other Significant Adverse Environmental consequences of mining ... Fresh water required for washing and sorting rock is in short supply.

Market delivered by barge to East Coast ports but use is limited as the material does not meet FDOT specifications.

Summary ... Not practicable as Lake Belt alternative because material is not FDOT approved, there are limited reserves, extreme logistical and cost problems in loading vessels in Freeport, unloading in Florida port, and providing rail transport to Lake Belt service area. Huge capital investment would be required to increase production and provide large scale distribution to Florida and Lake Belt service area.

## **APPENDIX B.**

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From USGS Mineral Industry Surveys  
Crushed Stone and Sand and Gravel  
Data for 1998

STATE	*short tons (2,000 pounds)						Total Crushed	Total Crushed	Total Crushed	State Population	Tons*/ Capita
	Crushed Stone Tons* (000)	Crushed Stone Value (000)	Crushed Stone Dollars/ Ton*	Sand and Gravel Tons* (000)	Sand and Gravel Value (000)	Sand and Gravel Dollars/ Ton*	Stone plus Sand and Gravel Tons* (000)	Stone plus Sand and Gravel Value (000)	Stone plus Sand and Gravel Dollars/ Ton*		
1 Alabama	50,285	\$308,000	\$6.13	15,984	\$65,600	\$4.10	66,249	\$373,600	\$5.64	4,351,999	15.2
2 Alaska	3,527	\$22,400	\$6.35	13,779	\$57,400	\$4.17	17,306	\$79,800	\$4.61	614,010	28.2
3 Arizona	8,157	\$43,300	\$5.31	51,698	\$229,000	\$4.43	59,856	\$272,300	\$4.55	4,668,631	12.8
4 Arkansas	42,549	\$241,000	\$5.66	12,456	\$52,800	\$4.24	55,005	\$293,800	\$5.34	2,538,303	21.7
5 California	63,052	\$395,000	\$6.26	137,789	\$752,000	\$5.46	200,841	\$1,147,000	\$5.71	32,666,550	6.1
6 Colorado	13,228	\$78,900	\$5.96	41,557	\$172,000	\$4.14	54,785	\$250,900	\$4.58	3,970,971	13.8
7 Connecticut	8,047	\$73,000	\$9.07	7,066	\$31,600	\$4.47	15,113	\$104,600	\$6.92	3,274,069	4.6
8 Delaware	-	-	-	2,469	\$11,200	\$4.54	2,469	\$11,200	\$4.54	743,603	3.3
9 Florida	90,059	\$449,000	\$4.99	22,156	\$81,200	\$3.66	112,215	\$530,200	\$4.72	14,915,980	7.5
10 Georgia	78,264	\$476,000	\$6.08	7,716	\$27,800	\$3.60	85,980	\$503,800	\$5.86	7,642,207	11.3
11 Hawaii	5,512	\$50,000	\$9.07	417	\$4,210	\$10.10	5,928	\$54,210	\$9.14	1,193,001	5.0
12 Idaho	3,307	\$13,500	\$4.08	17,086	\$46,000	\$2.69	20,393	\$59,500	\$2.92	1,228,684	16.6
13 Illinois	75,288	\$376,000	\$4.99	37,258	\$149,000	\$4.00	112,546	\$525,000	\$4.66	12,045,326	9.3
14 Indiana	67,021	\$289,000	\$4.31	26,015	\$103,000	\$3.96	93,035	\$392,000	\$4.21	5,899,195	15.8
15 Iowa	44,533	\$234,000	\$5.25	14,330	\$54,700	\$3.82	58,863	\$288,700	\$4.90	2,862,447	20.6
16 Kansas	24,912	\$102,000	\$4.09	10,748	\$28,300	\$2.63	35,660	\$130,300	\$3.65	2,629,067	13.6
17 Kentucky	67,572	\$282,000	\$4.17	8,675	\$26,500	\$3.05	76,247	\$308,500	\$4.05	3,936,499	19.4
18 Louisiana	1,764	\$16,200	\$9.19	13,889	\$58,300	\$4.20	15,653	\$74,500	\$4.76	4,368,967	3.6
19 Maine	3,086	\$16,800	\$5.44	7,826	\$33,100	\$4.23	10,913	\$49,900	\$4.57	1,244,250	8.8
20 Maryland	23,149	\$126,000	\$5.44	12,897	\$78,200	\$6.06	36,046	\$204,200	\$5.67	5,134,808	7.0
21 Massachusetts	14,440	\$91,700	\$6.35	15,432	\$76,600	\$4.96	29,873	\$168,300	\$5.63	6,147,132	4.9
22 Michigan	46,297	\$158,000	\$3.41	68,013	\$229,000	\$3.37	114,310	\$387,000	\$3.39	9,817,242	11.6
23 Minnesota	16,976	\$88,500	\$5.21	36,266	\$124,000	\$3.42	53,242	\$212,500	\$3.99	4,725,419	11.3
24 Mississippi	5,401	\$29,400	\$5.44	17,196	\$73,300	\$4.26	22,597	\$102,700	\$4.54	2,752,092	8.2
25 Missouri	81,902	\$409,000	\$4.99	9,215	\$32,100	\$3.48	91,117	\$441,100	\$4.84	5,438,559	16.8
26 Montana	2,976	\$12,100	\$4.07	9,656	\$33,100	\$3.43	12,632	\$45,200	\$3.58	880,453	14.3
27 Nebraska	7,716	\$46,900	\$6.08	15,673	\$50,600	\$3.19	23,389	\$97,500	\$4.13	1,662,719	14.2
28 Nevada	6,173	\$46,200	\$7.48	27,778	\$121,000	\$4.36	33,951	\$167,200	\$4.92	1,746,898	19.4
29 New Hampshire	2,425	\$14,100	\$5.81	9,656	\$39,000	\$4.04	12,081	\$53,100	\$4.40	1,185,048	10.2
30 New Jersey	27,337	\$174,000	\$6.36	19,952	\$99,200	\$4.97	47,289	\$273,200	\$5.78	8,115,011	5.8
31 New Mexico	5,181	\$28,200	\$5.44	11,795	\$55,000	\$4.66	16,976	\$83,200	\$4.90	1,736,931	9.8
32 New York	50,706	\$322,000	\$6.35	35,384	\$167,000	\$4.72	86,091	\$489,000	\$5.68	18,175,301	4.7
33 North Carolina	71,650	\$507,000	\$7.08	11,464	\$59,500	\$5.19	83,114	\$566,500	\$6.82	7,546,493	11.0
34 North Dakota	-	-	-	10,318	\$27,600	\$2.68	10,318	\$27,600	\$2.68	638,244	16.2
35 Ohio	89,177	\$485,000	\$5.44	55,226	\$244,000	\$4.42	144,403	\$729,000	\$5.05	11,209,493	12.9
36 Oklahoma	35,825	\$117,000	\$3.27	9,844	\$32,300	\$3.28	45,669	\$149,300	\$3.27	3,346,713	13.6
37 Oregon	21,716	\$98,500	\$4.54	18,298	\$89,700	\$4.90	40,014	\$188,200	\$4.70	3,281,974	12.2
38 Pennsylvania	100,200	\$564,000	\$5.63	20,283	\$107,000	\$5.28	120,483	\$671,000	\$5.57	12,001,451	10.0
39 Rhode Island	1,984	\$10,800	\$5.44	2,282	\$17,000	\$7.45	4,266	\$27,800	\$6.62	988,480	4.3
40 South Carolina	30,203	\$216,000	\$7.15	9,667	\$33,800	\$3.50	39,871	\$249,800	\$6.27	3,835,962	10.4
41 South Dakota	6,614	\$30,600	\$4.63	10,847	\$34,100	\$3.14	17,461	\$64,700	\$3.71	738,171	23.7
42 Tennessee	70,548	\$384,000	\$5.44	9,998	\$42,600	\$4.26	80,546	\$426,600	\$5.30	5,430,621	14.8
43 Texas	102,515	\$465,000	\$4.54	74,406	\$328,000	\$4.41	176,921	\$793,000	\$4.48	19,759,614	9.0
44 Utah	13,007	\$54,300	\$4.17	44,864	\$125,000	\$2.79	57,871	\$179,300	\$3.10	2,099,758	27.6
45 Vermont	9,259	\$50,400	\$5.44	4,740	\$18,000	\$3.80	13,999	\$68,400	\$4.89	590,883	23.7
46 Virginia	81,130	\$442,000	\$5.45	11,684	\$54,000	\$4.62	92,815	\$496,000	\$5.34	6,791,345	13.7
47 Washington	15,873	\$86,400	\$5.44	51,257	\$213,000	\$4.16	67,131	\$299,400	\$4.46	5,689,263	11.8
48 West Virginia	14,330	\$78,000	\$5.44	1,764	\$7,860	\$4.46	16,094	\$85,860	\$5.33	1,811,156	8.9
49 Wisconsin	30,424	\$110,000	\$3.62	33,731	\$103,000	\$3.05	64,155	\$213,000	\$3.32	5,223,500	12.3
50 Wyoming	6,504	\$35,400	\$5.44	4,244	\$15,800	\$3.72	10,748	\$51,200	\$4.76	480,907	22.3
	1,641,782	\$8,746,600	\$5.33	1,122,944	\$4,714,070	\$4.20	2,764,727	\$13,460,670	\$4.87	269,775,400	10.2

From USGS Mineral Industry Surveys  
Crushed Stone and Sand and Gravel  
Data for 1998

STATE	*short tons (2,000 pounds)						Total Crushed			State Population	Tons/ Capita
	Crushed Stone Tons (000)	Crushed Stone Value (000)	Crushed Stone Dollars/ Ton*	Sand and Gravel Tons* (000)	Sand and Gravel Value (000)	Sand and Gravel Dollars/ Ton*	Stone plus Sand and Gravel Tons* (000)	Stone plus Sand and Gravel Value (000)	Stone plus Sand and Gravel Dollars/ Ton*		
1 Texas	102,516	\$465,000	\$4.54	74,406	\$328,000	\$4.41	176,921	\$793,000	\$4.48	19,759,614	9.0
2 Pennsylvania	100,200	\$564,000	\$5.63	20,283	\$107,000	\$5.28	120,483	\$671,000	\$5.57	12,001,451	10.0
3 Florida	90,059	\$449,000	\$4.99	22,156	\$81,200	\$3.66	112,215	\$530,200	\$4.72	14,915,980	7.5
4 Ohio	89,177	\$485,000	\$5.44	55,226	\$244,000	\$4.42	144,403	\$729,000	\$5.05	11,209,493	12.9
5 Missouri	81,902	\$409,000	\$4.99	9,215	\$32,100	\$3.48	91,117	\$441,100	\$4.84	5,438,559	16.8
6 Virginia	81,150	\$442,000	\$5.45	11,684	\$54,000	\$4.62	92,835	\$496,000	\$5.34	6,791,345	13.7
7 Georgia	78,281	\$476,000	\$6.08	7,716	\$27,800	\$3.60	85,990	\$503,800	\$5.86	7,642,207	11.3
8 Illinois	75,286	\$376,000	\$4.99	37,258	\$149,000	\$4.00	112,546	\$525,000	\$4.66	12,045,326	9.3
9 North Carolina	71,050	\$507,000	\$7.08	11,464	\$59,500	\$5.19	83,114	\$566,500	\$6.82	7,546,493	11.0
10 Tennessee	70,516	\$384,000	\$5.44	9,998	\$42,800	\$4.26	80,546	\$426,800	\$5.30	5,430,621	14.8
11 Kentucky	67,572	\$282,000	\$4.17	8,675	\$26,500	\$3.05	76,247	\$308,500	\$4.05	3,936,499	19.4
12 Indiana	67,021	\$289,000	\$4.31	26,015	\$103,000	\$3.96	93,035	\$392,000	\$4.21	5,899,195	15.8
13 California	64,052	\$395,000	\$6.28	137,789	\$752,000	\$5.46	200,841	\$1,147,000	\$5.71	32,666,550	6.1
14 New York	60,706	\$322,000	\$6.35	35,384	\$167,000	\$4.72	86,091	\$489,000	\$5.68	18,175,301	4.7
15 Alabama	50,265	\$308,000	\$6.13	15,984	\$65,600	\$4.10	66,249	\$373,600	\$5.64	4,351,999	15.2
16 Michigan	46,297	\$158,000	\$3.41	68,013	\$229,000	\$3.37	114,310	\$387,000	\$3.39	9,817,242	11.6
17 Iowa	44,383	\$234,000	\$5.25	14,330	\$54,700	\$3.82	58,663	\$288,700	\$4.90	2,862,447	20.6
18 Arkansas	43,319	\$241,000	\$5.66	12,456	\$52,800	\$4.24	55,005	\$293,800	\$5.34	2,538,303	21.7
19 Oklahoma	35,825	\$117,000	\$3.27	9,844	\$32,300	\$3.28	45,669	\$149,300	\$3.27	3,346,713	13.6
20 Wisconsin	30,424	\$110,000	\$3.62	33,731	\$103,000	\$3.05	64,155	\$213,000	\$3.32	5,223,500	12.3
21 South Carolina	30,203	\$216,000	\$7.15	9,667	\$33,800	\$3.50	39,871	\$249,800	\$6.27	3,835,962	10.4
22 New Jersey	27,487	\$174,000	\$6.36	19,952	\$99,200	\$4.97	47,289	\$273,200	\$5.78	8,115,011	5.8
23 Kansas	24,812	\$102,000	\$4.09	10,748	\$28,300	\$2.63	35,660	\$130,300	\$3.65	2,629,067	13.6
24 Maryland	23,149	\$126,000	\$5.44	12,897	\$78,200	\$6.06	36,046	\$204,200	\$5.67	5,134,808	7.0
25 Oregon	21,716	\$98,500	\$4.54	18,298	\$89,700	\$4.90	40,014	\$188,200	\$4.70	3,281,974	12.2
26 Minnesota	16,976	\$88,500	\$5.21	36,266	\$124,000	\$3.42	53,242	\$212,500	\$3.99	4,725,419	11.3
27 Washington	15,873	\$86,400	\$5.44	51,257	\$213,000	\$4.16	67,131	\$299,400	\$4.46	5,689,263	11.8
28 Massachusetts	14,416	\$91,700	\$6.35	15,432	\$76,800	\$4.96	29,873	\$168,300	\$5.63	6,147,132	4.9
29 West Virginia	13,350	\$78,000	\$5.84	1,764	\$7,860	\$4.46	16,084	\$85,860	\$5.33	1,811,156	8.9
30 Colorado	13,226	\$78,900	\$5.96	41,557	\$172,000	\$4.14	54,785	\$250,900	\$4.58	3,970,971	13.8
31 Utah	13,007	\$54,300	\$4.17	44,864	\$125,000	\$2.79	57,871	\$179,300	\$3.10	2,099,758	27.6
32 Vermont	9,459	\$50,400	\$5.34	4,740	\$18,000	\$3.80	13,999	\$68,400	\$4.89	590,883	23.7
33 Arizona	8,157	\$43,300	\$5.31	51,698	\$229,000	\$4.43	59,856	\$272,300	\$4.55	4,668,631	12.8
34 Connecticut	8,047	\$73,000	\$9.07	7,066	\$31,800	\$4.47	15,113	\$104,800	\$6.92	3,274,069	4.6
35 Nebraska	7,716	\$46,900	\$6.08	15,873	\$50,800	\$3.19	23,589	\$97,500	\$4.13	1,662,719	14.2
36 South Dakota	6,614	\$30,600	\$4.63	10,847	\$34,100	\$3.14	17,461	\$64,700	\$3.71	738,171	23.7
37 Wyoming	6,504	\$35,400	\$5.44	4,244	\$15,800	\$3.72	10,748	\$51,200	\$4.76	480,907	22.3
38 Nevada	6,173	\$46,200	\$7.48	27,778	\$121,000	\$4.36	33,951	\$167,200	\$4.92	1,746,898	19.4
39 Hawaii	5,512	\$50,000	\$9.07	417	\$4,210	\$10.10	5,928	\$54,210	\$9.14	1,193,001	5.0
40 Mississippi	5,161	\$29,400	\$5.70	17,196	\$73,300	\$4.26	22,597	\$102,700	\$4.54	2,752,092	8.2
41 New Mexico	5,161	\$28,200	\$5.44	11,795	\$55,000	\$4.66	16,976	\$83,200	\$4.90	1,736,931	9.8
42 Alaska	3,327	\$22,400	\$6.73	13,779	\$57,400	\$4.17	17,306	\$79,800	\$4.61	614,010	28.2
43 Idaho	3,307	\$13,500	\$4.08	17,086	\$46,000	\$2.69	20,393	\$59,500	\$2.92	1,228,684	16.6
44 Maine	3,088	\$16,800	\$5.44	7,826	\$33,100	\$4.23	10,913	\$49,900	\$4.57	1,244,250	8.8
45 Montana	2,975	\$12,100	\$4.07	9,656	\$33,100	\$3.43	12,632	\$45,200	\$3.58	880,453	14.3
46 New Hampshire	2,925	\$14,100	\$5.81	9,656	\$39,000	\$4.04	12,081	\$53,100	\$4.40	1,185,048	10.2
47 Rhode Island	1,884	\$10,800	\$5.73	2,282	\$17,000	\$7.45	4,266	\$27,800	\$6.52	988,480	4.3
48 Louisiana	1,764	\$16,200	\$9.19	13,889	\$58,300	\$4.20	15,653	\$74,500	\$4.76	4,368,967	3.6
49 Delaware	-	-	-	2,469	\$11,200	\$4.54	2,469	\$11,200	\$4.54	743,603	3.3
50 North Dakota	-	-	-	10,318	\$27,600	\$2.68	10,318	\$27,600	\$2.68	638,244	16.2
	1,641,782	\$8,746,600	\$5.33	1,122,944	\$4,714,070	\$4.20	2,764,727	\$13,460,670	\$4.87	269,775,400	10.2

From USGS Mineral Industry Surveys  
Crushed Stone and Sand and Gravel  
Data for 1998

STATE	*short tons (2,000 pounds)						Total Crushed			State Population	Tons/ Capita
	Crushed Stone Tons* (000)	Crushed Stone Value (000)	Crushed Stone Dollars/ Ton*	Sand and Gravel Tons* (000)	Sand and Gravel Value (000)	Sand and Gravel Dollars/ Ton*	Stone plus Sand and Gravel Tons* (000)	Stone plus Sand and Gravel Value (000)	Stone plus Sand and Gravel Dollars/ Ton*		
1 California	63,052	\$395,000	\$6.26	87,789	\$752,000	\$5.46	200,841	\$1,147,000	\$5.71	32,666,550	6.1
2 Texas	102,515	\$465,000	\$4.54	74,905	\$328,000	\$4.41	178,921	\$793,000	\$4.48	19,759,614	9.0
3 Michigan	46,297	\$158,000	\$3.41	68,013	\$229,000	\$3.37	114,310	\$387,000	\$3.39	9,817,242	11.6
4 Ohio	89,177	\$485,000	\$5.44	55,228	\$244,000	\$4.42	144,403	\$729,000	\$5.05	11,209,493	12.9
5 Arizona	8,157	\$43,300	\$5.31	51,088	\$229,000	\$4.43	59,856	\$272,300	\$4.55	4,668,631	12.8
6 Washington	15,873	\$86,400	\$5.44	51,257	\$213,000	\$4.16	67,131	\$299,400	\$4.46	5,689,263	11.8
7 Utah	13,007	\$54,300	\$4.17	49,684	\$125,000	\$2.79	57,871	\$179,300	\$3.10	2,099,758	27.6
8 Colorado	13,228	\$78,900	\$5.96	48,497	\$172,000	\$4.14	54,785	\$250,900	\$4.58	3,970,971	13.8
9 Illinois	75,288	\$376,000	\$4.99	37,284	\$149,000	\$4.00	112,546	\$525,000	\$4.66	12,045,326	9.3
10 Minnesota	16,978	\$88,500	\$5.21	36,236	\$124,000	\$3.42	53,242	\$212,500	\$3.99	4,725,419	11.3
11 New York	50,706	\$322,000	\$6.35	35,984	\$167,000	\$4.72	86,091	\$489,000	\$5.68	18,175,301	4.7
12 Wisconsin	30,424	\$110,000	\$3.62	38,231	\$103,000	\$3.05	64,155	\$213,000	\$3.32	5,223,500	12.3
13 Nevada	6,173	\$46,200	\$7.48	27,773	\$121,000	\$4.36	33,951	\$167,200	\$4.92	1,746,898	19.4
14 Indiana	67,021	\$289,000	\$4.31	26,915	\$103,000	\$3.96	93,035	\$392,000	\$4.21	5,899,195	15.8
15 Florida	90,059	\$449,000	\$4.99	22,156	\$81,200	\$3.66	112,215	\$530,200	\$4.72	14,915,980	7.5
16 Pennsylvania	100,200	\$564,000	\$5.63	20,233	\$107,000	\$5.28	120,483	\$671,000	\$5.57	12,001,451	10.0
17 New Jersey	27,337	\$174,000	\$6.36	19,154	\$99,200	\$4.97	47,289	\$273,200	\$5.78	8,115,011	5.8
18 Oregon	21,716	\$98,500	\$4.54	16,245	\$89,700	\$4.90	40,014	\$188,200	\$4.70	3,281,974	12.2
19 Mississippi	5,401	\$29,400	\$5.44	17,035	\$73,300	\$4.26	22,597	\$102,700	\$4.54	2,752,092	8.2
20 Idaho	3,307	\$13,500	\$4.08	14,085	\$46,000	\$2.69	20,393	\$59,500	\$2.92	1,228,684	16.6
21 Alabama	50,285	\$308,000	\$6.13	15,924	\$65,600	\$4.10	66,249	\$373,600	\$5.64	4,351,999	15.2
22 Nebraska	7,716	\$46,900	\$6.08	15,976	\$50,600	\$3.19	23,589	\$97,500	\$4.13	1,662,719	14.2
23 Massachusetts	14,440	\$91,700	\$6.35	15,822	\$76,800	\$4.86	29,873	\$168,300	\$5.63	6,147,132	4.9
24 Iowa	44,533	\$234,000	\$5.25	14,380	\$54,700	\$3.82	58,863	\$288,700	\$4.90	2,862,447	20.6
25 Louisiana	\$1,784	\$16,200	\$9.19	13,889	\$58,300	\$4.20	15,853	\$74,500	\$4.76	4,368,967	3.6
26 Alaska	3,527	\$22,400	\$6.35	8,729	\$57,400	\$4.17	17,308	\$79,800	\$4.61	614,010	28.2
27 Maryland	23,149	\$126,000	\$5.44	12,857	\$78,200	\$6.08	36,046	\$204,200	\$5.67	5,134,808	7.0
28 Arkansas	42,549	\$241,000	\$5.66	12,166	\$52,800	\$4.24	55,005	\$293,800	\$5.34	2,538,303	21.7
29 New Mexico	5,181	\$28,200	\$5.44	11,795	\$55,000	\$4.66	16,976	\$83,200	\$4.90	1,736,931	9.8
30 Virginia	81,130	\$442,000	\$5.45	15,834	\$64,000	\$4.62	92,815	\$496,000	\$5.34	6,791,345	13.7
31 North Carolina	71,650	\$507,000	\$7.08	11,164	\$59,500	\$5.19	83,114	\$566,500	\$6.82	7,546,493	11.0
32 South Dakota	\$6,614	\$30,600	\$4.63	10,347	\$34,100	\$3.14	17,481	\$64,700	\$3.71	738,171	23.7
33 Kansas	\$24,912	\$102,000	\$4.09	10,719	\$28,300	\$2.63	35,660	\$130,300	\$3.65	2,629,067	13.6
34 North Dakota	-	-	-	10,316	\$27,600	\$2.68	10,318	\$27,600	\$2.68	638,244	16.2
35 Tennessee	70,548	\$384,000	\$5.44	9,991	\$42,600	\$4.26	80,546	\$426,600	\$5.30	5,430,621	14.8
36 Oklahoma	35,825	\$117,000	\$3.27	9,844	\$32,300	\$3.28	45,669	\$149,300	\$3.27	3,346,713	13.6
37 South Carolina	30,203	\$216,000	\$7.15	9,459	\$33,800	\$3.50	39,871	\$249,800	\$6.27	3,835,962	10.4
38 Montana	2,976	\$12,100	\$4.07	9,859	\$33,100	\$3.43	12,832	\$45,200	\$3.58	880,453	14.3
39 New Hampshire	\$2,425	\$14,100	\$5.81	9,855	\$39,000	\$4.04	12,081	\$53,100	\$4.40	1,185,048	10.2
40 Missouri	81,902	\$409,000	\$4.99	9,316	\$32,100	\$3.48	91,117	\$441,100	\$4.84	5,438,559	16.8
41 Kentucky	67,572	\$282,000	\$4.17	9,275	\$26,500	\$3.05	76,247	\$308,500	\$4.05	3,936,499	19.4
42 Maine	3,086	\$16,800	\$5.44	7,826	\$33,100	\$4.23	10,913	\$49,900	\$4.57	1,244,250	8.8
43 Georgia	78,264	\$476,000	\$6.08	7,710	\$27,800	\$3.60	85,980	\$503,800	\$5.86	7,642,207	11.3
44 Connecticut	8,047	\$73,000	\$9.07	7,069	\$31,600	\$4.47	15,113	\$104,600	\$6.92	3,274,089	4.6
45 Vermont	9,259	\$50,400	\$5.44	6,710	\$18,000	\$3.80	13,999	\$68,400	\$4.89	590,883	23.7
46 Wyoming	6,504	\$35,400	\$5.44	1,241	\$15,800	\$3.72	10,748	\$51,200	\$4.76	480,907	22.3
47 Delaware	-	-	-	2,469	\$11,200	\$4.54	2,469	\$11,200	\$4.54	743,603	3.3
48 Rhode Island	1,984	\$10,800	\$5.44	2,282	\$17,000	\$7.45	4,266	\$27,800	\$6.52	988,480	4.3
49 West Virginia	14,330	\$78,000	\$5.44	1,764	\$7,860	\$4.46	16,094	\$85,860	\$5.33	1,811,156	8.9
50 Hawaii	5,512	\$50,000	\$9.07	474	\$4,210	\$10.10	5,928	\$54,210	\$9.14	1,193,001	5.0
	1,641,782	\$8,746,600	\$5.33	1,122,944	\$4,714,070	\$4.20	2,764,727	\$13,460,670	\$4.87	269,775,400	10.2

From USGS Mineral Industry Surveys  
Crushed Stone and Sand and Gravel  
Data for 1998

STATE	*short tons (2,000 pounds)						Total Crushed Stone plus Sand and Gravel			State Population	Tons*/Capita
	Crushed Stone Tons* (000)	Crushed Stone Value (000)	Crushed Stone Dollars/Ton*	Sand and Gravel Tons* (000)	Sand and Gravel Value (000)	Sand and Gravel Dollars/Ton*	Stone plus Sand and Gravel Tons* (000)	Stone plus Sand and Gravel Value (000)	Stone plus Sand and Gravel Dollars/Ton*		
1 California	63,052	\$395,000	\$6.26	137,789	\$752,000	\$5.46	200,841	\$1,147,000	\$5.71	32,666,550	6.1
2 Texas	102,515	\$465,000	\$4.54	74,406	\$328,000	\$4.41	176,921	\$793,000	\$4.48	19,759,614	9.0
3 Ohio	89,177	\$485,000	\$5.44	55,226	\$244,000	\$4.42	144,403	\$729,000	\$5.05	11,209,493	12.9
4 Pennsylvania	100,200	\$564,000	\$5.63	20,283	\$107,000	\$5.28	120,483	\$671,000	\$5.57	12,001,451	10.0
5 Michigan	46,297	\$158,000	\$3.41	68,013	\$229,000	\$3.37	114,310	\$387,000	\$3.39	9,817,242	11.6
6 Illinois	75,288	\$376,000	\$4.99	37,258	\$149,000	\$4.00	112,546	\$525,000	\$4.66	12,045,326	9.3
7 Florida	90,059	\$449,000	\$4.99	22,156	\$81,200	\$3.66	112,215	\$530,200	\$4.72	14,915,980	7.5
8 Indiana	67,021	\$289,000	\$4.31	26,015	\$103,000	\$3.96	93,036	\$392,000	\$4.21	5,899,195	15.8
9 Virginia	81,130	\$442,000	\$5.45	11,684	\$54,000	\$4.62	92,814	\$496,000	\$5.34	6,791,345	13.7
10 Missouri	81,902	\$409,000	\$4.99	9,215	\$32,100	\$3.48	91,117	\$441,100	\$4.84	5,438,559	16.8
11 New York	50,706	\$322,000	\$6.35	35,384	\$167,000	\$4.72	86,090	\$489,000	\$5.68	18,175,301	4.7
12 Georgia	78,264	\$476,000	\$6.08	7,716	\$27,800	\$3.60	85,980	\$503,800	\$5.86	7,642,207	11.3
13 North Carolina	71,650	\$507,000	\$7.08	11,464	\$69,500	\$5.19	83,114	\$566,500	\$6.82	7,546,493	11.0
14 Tennessee	70,548	\$384,000	\$5.44	9,998	\$42,600	\$4.26	80,546	\$426,600	\$5.30	5,430,621	14.8
15 Kentucky	67,572	\$282,000	\$4.17	8,675	\$26,500	\$3.05	76,247	\$308,500	\$4.05	3,936,499	19.4
16 Washington	15,873	\$86,400	\$5.44	51,257	\$213,000	\$4.16	67,130	\$299,400	\$4.46	5,689,263	11.8
17 Alabama	50,265	\$308,000	\$6.13	15,984	\$65,600	\$4.10	66,249	\$373,600	\$5.64	4,351,999	15.2
18 Wisconsin	30,424	\$110,000	\$3.62	33,731	\$103,000	\$3.05	64,155	\$213,000	\$3.32	5,223,500	12.3
19 Arizona	8,157	\$43,300	\$5.31	51,698	\$229,000	\$4.43	59,855	\$272,300	\$4.55	4,688,631	12.8
20 Iowa	44,533	\$234,000	\$5.25	14,330	\$54,700	\$3.82	58,863	\$288,700	\$4.90	2,862,447	20.6
21 Utah	13,007	\$54,300	\$4.17	44,864	\$125,000	\$2.79	57,871	\$179,300	\$3.10	2,099,758	27.6
22 Arkansas	42,549	\$241,000	\$5.66	12,456	\$52,800	\$4.24	55,005	\$293,800	\$5.34	2,536,303	21.7
23 Colorado	13,228	\$78,900	\$5.96	41,557	\$172,000	\$4.14	54,785	\$250,900	\$4.58	3,970,971	13.8
24 Minnesota	16,976	\$88,500	\$5.21	36,266	\$124,000	\$3.42	53,242	\$212,500	\$3.99	4,725,419	11.3
25 New Jersey	27,337	\$174,000	\$6.36	19,952	\$99,200	\$4.97	47,289	\$273,200	\$5.78	8,115,011	5.8
26 Oklahoma	35,825	\$117,000	\$3.27	9,844	\$32,300	\$3.28	45,669	\$149,300	\$3.27	3,346,713	13.6
27 Oregon	21,716	\$98,500	\$4.54	18,298	\$89,700	\$4.90	40,014	\$188,200	\$4.70	3,281,974	12.2
28 South Carolina	30,203	\$216,000	\$7.15	9,667	\$33,800	\$3.50	39,870	\$249,800	\$6.27	3,635,962	10.4
29 Maryland	23,149	\$126,000	\$5.44	12,897	\$78,200	\$6.08	36,046	\$204,200	\$5.67	5,134,808	7.0
30 Kansas	\$24,912	\$102,000	\$4.09	10,748	\$28,300	\$2.63	35,660	\$130,300	\$3.65	2,629,067	13.6
31 Nevada	6,173	\$46,200	\$7.48	27,778	\$121,000	\$4.36	33,951	\$167,200	\$4.92	1,746,898	19.4
32 Massachusetts	14,440	\$91,700	\$6.35	15,432	\$76,600	\$4.96	29,872	\$168,300	\$5.63	6,147,132	4.9
33 Nebraska	7,716	\$46,900	\$6.08	15,873	\$50,600	\$3.19	23,589	\$97,500	\$4.13	1,662,719	14.2
34 Mississippi	5,401	\$29,400	\$5.44	17,196	\$73,300	\$4.26	22,597	\$102,700	\$4.54	2,752,092	8.2
35 Idaho	3,307	\$13,500	\$4.08	17,086	\$46,000	\$2.69	20,393	\$59,500	\$2.92	1,228,684	16.6
36 South Dakota	\$6,614	\$30,600	\$4.63	10,847	\$34,100	\$3.14	17,461	\$64,700	\$3.71	738,171	23.7
37 Alaska	3,527	\$22,400	\$6.35	13,779	\$57,400	\$4.17	17,306	\$79,800	\$4.61	614,010	28.2
38 New Mexico	5,181	\$28,200	\$5.44	11,795	\$55,000	\$4.66	16,976	\$83,200	\$4.90	1,736,931	9.8
39 West Virginia	14,330	\$78,000	\$5.44	1,764	\$7,860	\$4.46	16,094	\$85,860	\$5.33	1,811,156	8.9
40 Louisiana	\$1,764	\$16,200	\$9.19	13,889	\$58,300	\$4.20	15,653	\$74,500	\$4.76	4,368,967	3.6
41 Connecticut	8,047	\$73,000	\$9.07	7,066	\$31,800	\$4.47	15,113	\$104,800	\$6.92	3,274,069	4.6
42 Vermont	9,259	\$50,400	\$5.44	4,740	\$18,000	\$3.80	13,999	\$68,400	\$4.89	590,883	23.7
43 Montana	2,976	\$12,100	\$4.07	9,656	\$33,100	\$3.43	12,632	\$45,200	\$3.58	880,453	14.3
44 New Hampshire	2,425	\$14,100	\$5.81	9,656	\$39,000	\$4.04	12,081	\$53,100	\$4.40	1,185,048	10.2
45 Maine	3,086	\$16,800	\$5.44	7,826	\$33,100	\$4.23	10,912	\$49,900	\$4.57	1,244,250	8.8
46 Wyoming	6,504	\$35,400	\$5.44	4,244	\$15,800	\$3.72	10,748	\$51,200	\$4.76	480,907	22.3
47 North Dakota	-	-	-	10,318	\$27,600	\$2.68	10,318	\$27,600	\$2.68	638,244	16.2
48 Hawaii	5,512	\$50,000	\$9.07	417	\$4,210	\$10.10	5,929	\$54,210	\$9.14	1,193,001	5.0
49 Rhode Island	1,984	\$10,800	\$5.44	2,282	\$17,000	\$7.45	4,266	\$27,800	\$6.52	988,480	4.3
50 Delaware	-	-	-	2,469	\$11,200	\$4.54	2,469	\$11,200	\$4.54	743,603	3.3
	1,641,782	\$8,746,600	\$5.33	1,122,944	\$4,714,070	\$4.20	2,764,727	\$13,460,670	\$4.87	269,775,400	10.2

From USGS Mineral Industry Surveys  
Crushed Stone and Sand and Gravel  
Data for 1998

STATE	*short tons (2,000 pounds)						Total Crushed			State Population	Tons/ Capita
	Crushed Stone Tons* (000)	Crushed Stone Value (000)	Crushed Stone Dollars/ Ton*	Sand and Gravel Tons* (000)	Sand and Gravel Value (000)	Sand and Gravel Dollars/ Ton*	Stone plus Sand and Gravel Tons* (000)	Stone plus Sand and Gravel Value (000)	Stone plus Sand and Gravel Dollars/ Ton*		
1 California	63,052	\$395,000	\$6.26	137,789	\$752,000	\$5.46	200,841	\$1,147,000	\$5.71	32,568,550	6.1
2 Texas	102,515	\$465,000	\$4.54	74,406	\$328,000	\$4.41	176,921	\$793,000	\$4.48	19,759,817	9.0
3 New York	50,706	\$322,000	\$6.35	35,384	\$167,000	\$4.72	86,091	\$489,000	\$5.68	18,175,301	4.7
4 Florida	90,059	\$449,000	\$4.99	22,156	\$81,200	\$3.66	112,215	\$530,200	\$4.72	14,945,980	7.5
5 Illinois	75,288	\$376,000	\$4.99	37,258	\$149,000	\$4.00	112,546	\$525,000	\$4.66	12,045,326	9.3
6 Pennsylvania	100,200	\$564,000	\$5.63	20,283	\$107,000	\$5.28	120,483	\$671,000	\$5.57	12,001,455	10.0
7 Ohio	89,177	\$485,000	\$5.44	55,226	\$244,000	\$4.42	144,403	\$729,000	\$5.05	11,209,399	12.9
8 Michigan	46,297	\$158,000	\$3.41	68,013	\$229,000	\$3.37	114,310	\$387,000	\$3.39	9,817,249	11.6
9 New Jersey	27,337	\$174,000	\$6.36	19,952	\$89,200	\$4.97	47,289	\$273,200	\$5.78	8,115,011	5.8
10 Georgia	78,264	\$476,000	\$6.08	7,716	\$27,800	\$3.60	85,980	\$503,800	\$5.88	5,222,200	11.3
11 North Carolina	71,850	\$507,000	\$7.08	11,464	\$59,500	\$5.19	83,114	\$566,500	\$6.82	7,518,093	11.0
12 Virginia	81,130	\$442,000	\$5.45	11,684	\$54,000	\$4.62	92,815	\$496,000	\$5.34	6,701,445	13.7
13 Massachusetts	14,440	\$91,700	\$6.35	15,432	\$76,600	\$4.96	29,873	\$168,300	\$5.63	6,177,132	4.9
14 Indiana	67,021	\$289,000	\$4.31	26,015	\$103,000	\$3.96	93,035	\$392,000	\$4.21	5,392,155	15.8
15 Washington	15,873	\$86,400	\$5.44	51,257	\$213,000	\$4.16	67,131	\$299,400	\$4.46	5,689,268	11.8
16 Missouri	81,902	\$409,000	\$4.99	9,215	\$32,100	\$3.48	91,117	\$441,100	\$4.84	5,386,559	16.8
17 Tennessee	70,548	\$384,000	\$5.44	9,998	\$42,600	\$4.26	80,546	\$426,600	\$5.30	5,130,521	14.8
18 Wisconsin	30,424	\$110,000	\$3.62	33,731	\$103,000	\$3.05	64,155	\$213,000	\$3.32	5,223,500	12.3
19 Maryland	23,149	\$126,000	\$5.44	12,897	\$78,200	\$6.06	36,046	\$204,200	\$5.67	5,134,808	7.0
20 Minnesota	18,976	\$88,500	\$5.21	36,266	\$124,000	\$3.42	55,242	\$212,500	\$3.99	5,126,419	11.3
21 Arizona	8,157	\$43,300	\$5.31	51,698	\$229,000	\$4.43	59,856	\$272,300	\$4.55	3,685,031	12.8
22 Louisiana	\$1,764	\$16,200	\$9.19	13,889	\$58,300	\$4.20	15,653	\$74,500	\$4.76	3,365,967	3.6
23 Alabama	50,285	\$308,000	\$6.13	15,984	\$65,600	\$4.10	66,249	\$373,600	\$5.64	3,551,999	15.2
24 Colorado	13,228	\$78,900	\$5.96	41,557	\$172,000	\$4.14	54,785	\$250,900	\$4.58	3,970,911	13.8
25 Kentucky	67,572	\$282,000	\$4.17	8,675	\$26,500	\$3.05	76,247	\$308,500	\$4.05	3,556,499	19.4
26 South Carolina	30,203	\$216,000	\$7.15	9,667	\$33,800	\$3.50	39,871	\$249,800	\$6.27	3,635,962	10.4
27 Oklahoma	35,825	\$117,000	\$3.27	9,844	\$32,300	\$3.28	45,669	\$149,300	\$3.27	3,346,718	13.6
28 Oregon	21,716	\$98,500	\$4.54	18,298	\$89,700	\$4.90	40,014	\$188,200	\$4.70	3,281,974	12.2
29 Connecticut	8,047	\$73,000	\$9.07	7,066	\$31,600	\$4.47	15,113	\$104,600	\$6.92	3,274,069	4.6
30 Iowa	44,533	\$234,000	\$5.25	14,330	\$54,700	\$3.82	58,863	\$288,700	\$4.90	2,368,417	20.6
31 Mississippi	5,401	\$29,400	\$5.44	17,196	\$73,300	\$4.26	22,597	\$102,700	\$4.54	2,752,092	8.2
32 Kansas	\$24,912	\$102,000	\$4.09	10,748	\$28,300	\$2.63	35,660	\$130,300	\$3.65	2,829,157	13.6
33 Arkansas	42,549	\$241,000	\$5.66	12,456	\$52,800	\$4.24	55,005	\$293,800	\$5.34	2,338,303	21.7
34 Utah	13,007	\$54,300	\$4.17	44,864	\$125,000	\$2.79	57,871	\$179,300	\$3.10	2,099,758	27.6
35 West Virginia	14,330	\$78,000	\$5.44	1,764	\$7,860	\$4.46	16,094	\$85,860	\$5.33	1,811,156	8.9
36 Nevada	6,173	\$46,200	\$7.48	27,778	\$121,000	\$4.36	33,951	\$167,200	\$4.92	1,746,898	19.4
37 New Mexico	5,181	\$28,200	\$5.44	11,795	\$55,000	\$4.66	16,976	\$83,200	\$4.90	1,730,831	9.8
38 Nebraska	7,716	\$46,900	\$6.08	15,873	\$50,600	\$3.19	23,589	\$97,500	\$4.13	1,562,719	14.2
39 Maine	3,086	\$16,800	\$5.44	7,826	\$33,100	\$4.23	10,913	\$49,900	\$4.57	1,243,250	8.8
40 Idaho	3,307	\$13,500	\$4.08	17,086	\$46,000	\$2.69	20,393	\$59,500	\$2.92	1,226,084	16.6
41 Hawaii	5,512	\$50,000	\$9.07	417	\$4,210	\$10.10	5,928	\$54,210	\$9.14	1,091,001	5.0
42 New Hampshire	\$2,425	\$14,100	\$5.81	9,656	\$39,000	\$4.04	12,081	\$53,100	\$4.40	1,166,048	10.2
43 Rhode Island	1,984	\$10,800	\$5.44	2,282	\$17,000	\$7.45	4,266	\$27,800	\$6.52	885,480	4.3
44 Montana	2,976	\$12,100	\$4.07	9,656	\$33,100	\$3.43	12,632	\$45,200	\$3.58	880,453	14.3
45 Delaware	-	-	-	2,469	\$11,200	\$4.54	2,469	\$11,200	\$4.54	743,603	3.3
46 South Dakota	\$6,614	\$30,600	\$4.63	10,847	\$34,100	\$3.14	17,461	\$64,700	\$3.71	739,171	23.7
47 North Dakota	-	-	-	10,318	\$27,600	\$2.68	10,318	\$27,600	\$2.68	638,244	16.2
48 Alaska	3,527	\$22,400	\$6.35	13,779	\$57,400	\$4.17	17,306	\$79,800	\$4.61	614,010	28.2
49 Vermont	9,259	\$50,400	\$5.44	4,740	\$18,000	\$3.80	13,999	\$68,400	\$4.89	590,889	23.7
50 Wyoming	6,504	\$35,400	\$5.44	4,244	\$15,800	\$3.72	10,748	\$51,200	\$4.76	480,907	22.3
	1,641,782	\$8,746,600	\$5.33	1,122,944	\$4,714,070	\$4.20	2,764,727	\$13,460,670	\$4.87	269,775,400	10.2